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**University of Sussex**

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M.Phil

July 2010

**Cognitive Rehearsal, Cognitive Bias and the Development of  
Fear in High Trait-Anxious Children**

UNIVERSITY OF SUSSEX

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Anxious Children

## Summary

Previous research has shown that high trait-anxious children, relative to low trait-anxious children, are at an increased risk of developing fear due to threatening information (Field, 2006b; Field and Price-Evans, 2009). However, the mechanism that underlies this relationship remains unknown. Cognitive models of vulnerability to anxiety propose that biases in the processing of threat-relevant material play a part in the aetiology and maintenance of anxiety disorders (Beck and Clark, 1997; Eysenck, 1992) and as such could potentially explain the relationship between trait-anxiety and fear development in the face of ambiguous information in children. For example, high-anxious children tend to interpret ambiguous information in a more negative manner (interpretation bias) and remember ambiguous information as being more threatening than it was originally (memory bias) (see Hadwin and Field, 2010, for a review). Additionally, high-anxious children have been found to engage in negative cognitive rehearsal (Comer, Kendall, Franklin, Hudson, and Pimental, 2004). The experiments in this thesis investigated whether these cognitive biases underlie the relationship between trait anxiety and fear development in non-clinical children.

In a series of three experiments, children (aged 8-11 years) were presented with some ambiguous information regarding two novel animals (the quoll and the cuscus) and before completing a cognitive rehearsal task were told that they would soon be asked to approach the animals. There were several findings: 1) High trait-anxious children were not significantly more likely than low trait-anxious children to display any of the cognitive biases tested (i.e., interpretation bias, memory bias or cognitive rehearsal). However, tentative evidence suggested that interpretation bias exacerbated the relationship between trait anxiety and fear; 2) Whether children cognitively rehearsed the ambiguous information or not had no significant impact on their fear for the

animals, nor did the valence of their thoughts; 3) Children who interpreted the ambiguous information more negatively were more likely to become fearful of the animals and were also more likely to remember more negatively-biased and less positively-biased pieces of ambiguous information; 4) It was the lack of positively-biased memories *not* the increased number of negatively-biased memories that led children who interpreted the information more negatively to become more fearful of the animals as a result. The findings are discussed with reference to their implications for the theory and prevention of childhood fear: that positive interpretation and memory bias training may act to decrease or even help to prevent fear development in children.

I hereby declare that this thesis has not and will not be, submitted in whole or in part to another University for the award of any other degree.

Signature.....

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## **0 Organization of Thesis**

Chapter 1 is an overview of the cognitive characteristics of anxious individuals that are believed to play an important role in the aetiology and maintenance of long-term fear and anxiety, namely: attention bias to threat, interpretation bias, memory bias and cognitive rehearsal. In particular, it evaluates the evidence that these information-processing biases are present in both high trait anxious adults and children and considers them as potential mechanisms underlying the relationship between trait anxiety and the development of fear in the face of ambiguous information.

Chapters 2 to 4 describe a series of experiments that investigate interpretation bias, cognitive rehearsal and memory in high and low trait anxious children. The experiments are all identical with respect to interpretation bias and memory, for example, they all investigate whether these cognitive biases are present in high trait anxious children and whether they can explain the relationship between trait anxiety and fear. However, each of the experiments differ with respect to cognitive rehearsal:

Chapter 2 (Experiment 1) investigates whether highly trait anxious children relative to less trait anxious children have a natural tendency to cognitively rehearse ambiguous information regarding novel animals and the resulting effects on fear responding. Results revealed that highly trait anxious children are not more likely to cognitively rehearse ambiguous information and that cognitive rehearsal (in both high and low trait anxious children) does not significantly affect fear responding. Nevertheless, it was found that the majority of children cognitively rehearsed the ambiguous information about the animals; therefore, there was no control group of children to compare against the group of children who thought about the animal.

Chapter 3 (Experiment 2) looks at the causal effect of experimentally inducing cognitive rehearsal vs. distraction of ambiguous information about novel animals on fear beliefs and avoidance in children. Findings indicated that whether children were instructed to cognitively rehearse ambiguous information or were prevented from doing so via a distraction task did not significantly effect fear beliefs or avoidance towards the animals. However, it was found that in general children were having more threat thoughts than positive thoughts about the animals and so the effect of negative vs. positive cognitive rehearsal remains unknown.

Chapter 4 (Experiment 3) takes into account the content of children's thoughts and addresses whether experimental manipulation of either a positive or negative cognitive rehearsal style leads to differential fear responding towards novel animals in children. Results indicated that neither positive nor negative cognitive rehearsal significantly affects fear responding.

Chapter 5 examines the data from each of the three experiments when combined into one large data set. This was done because with regards to interpretation bias and memory, Experiments 1, 2 and 3 found fairly inconsistent results and it is possible that some of these inconsistencies were due to the relatively small sample sizes of each individual experiment. The main findings were:

- 1) children who were more trait anxious became more fearful of the animals due to ambiguous information;
- 2) Children who displayed a greater threat interpretation bias of the information became more fearful of the animals;
- 3) Neither a threat interpretation bias nor cognitive rehearsal was found to significantly mediate the relationship between trait anxiety and fear;
- 4) Children who engaged in negative cognitive rehearsal did not become significantly more fearful of the animals, although they did interpret the information in a significantly more threatening manner;
- 5) Children who displayed a greater threat interpretation bias remembered the information in a more negatively and less positively biased manner; however this relationship was not moderated

by trait anxiety; 6) Children who interpreted the information as being more threatening constructed fewer false positive memories of the ambiguous information, and in turn, became more fearful of the animals.

Chapter 6 discusses the findings from the experiments in relation to issues raised in the information processing bias literature and concludes that positive interpretation and memory bias training may act to decrease or even help to prevent fear development in children. It is suggested that no significant effects of cognitive rehearsal were found due to the ambiguous nature of the information and as such future research should investigate the effects of cognitive rehearsal in the face of a mildly threatening experience.

# **1 Background to the Cognitive Characteristics of Anxious Individuals**

## **1.1 Aims and Objectives of this Thesis**

The current experiments are designed to look at the effects of memory bias, interpretation bias and cognitive rehearsal when learning about new potentially threatening stimuli. This will (1) add to the extremely scant literature on memory biases and cognitive rehearsal in anxious children; and, (2) add to our knowledge of the *effect* that such processes have on learning and the interpretation of new potentially threatening information.

## **1.2 Chapter Overview**

Anxiety disorders are among the most prevalent forms of psychological disturbance affecting children and adolescents (Anderson, Williams, McGee, & Silva, 1987) and possibly even the most prevalent (Cartwright-Hatton, McNicol, & Doubleday, 2006). Studies illustrate that roughly 2.5% to 5% of children and adolescents meet criteria for an anxiety disorder at a given time (Ronald, Schniering, & Hudson, 2009). Anxiety in childhood is a serious problem and can have long term negative consequences in a number of important domains of child development, such as social and academic functioning (Pine, 1997) and has been linked to other major conditions, such as depression (Kovacs, Gatsonis, Paulauskas, & Richards, 1989) and substance misuse (Kushner, Sher, & Beitman, 1990). Although much anxiety in youth is normal and many childhood anxiety disorders remit within 3 to 4 years (Last, Perrin, Hersen, & Kazdin, 1996), many such disorders persist into adulthood (Last, Philips, & Statfield, 1987), and retrospective studies of adults suffering from an anxiety disorder indicate that most adults report the onset of their disorder in childhood, or at the latest, in adolescence (Kim-Cohen et al., 2003).



Given that we are now becoming increasingly aware that anxiety is a serious problem in childhood, it is important for us to recognize which particular characteristics of anxious children are likely to be at the root of their anxiety, or play a part in maintaining their anxiety. Such increased understanding may help to refine theories of anxiety pathology, facilitate accurate identification of children at risk for anxiety disorders and signify points of entry for both preventative and curative interventions. Cognitive models of vulnerability to anxiety propose that individual differences in the processing of threat-relevant material play a part in the aetiology and maintenance of anxiety disorders (Beck & Clark, 1997; Eysenck, 1992). For example, anxious people tend to selectively process information that is consistent with their view that the world is dangerous (see Ouimet, Gawronski & Dozois, 2009, for a review). As such, a large body of research has investigated the degree to which these information-processing biases are associated with symptoms of anxiety pathology (e.g., Mogg & Bradley, 2004).

In this chapter, evidence for the presence of each of the cognitive biases in anxious adults and children will be examined in turn, along with a discussion of the potential role that they may play in the development of fear. As part of this review, temperamental factors which are believed to increase vulnerability to anxiety will be considered in detail because a central hypothesis of this thesis is that children scoring high on the temperament dimension of ‘trait anxiety’ will be in a more general state of physiological arousal and therefore, more prone to acquiring fear in a given learning episode than children who are less trait anxious. There will also be a discussion into recent models of information processing biases, which have suggested how the cognitive biases might interact at different stages of information processing leading to the development of fear. This chapter begins though, with a discussion into what we mean by ‘fear’ and ‘anxiety’.

### **1.3 Definition of Fear and Anxiety**

Fear has been defined as a negative reaction to a specific threatening stimulus with escape or avoidance the outcome of increased threat proximity; anxiety on the other hand is regarded as being a more general state of distress, more enduring with less specific or more generalized cues, it involves heightened physiological arousal but does not necessarily lead to structured functional behaviour (Lang, Davis & Öhman, 2000). The current research will investigate the effects of ambiguous information and biased information processing on 'fear' because it is thought that the mechanisms of acquisition operate at an individual stimulus level (in a given learning episode we will be providing information about something specific, i.e., a novel animal). The difference between whether a child acquires 'fear' or 'anxiety' lies in the extent to which they have learning experiences about a specific group of related stimuli (fear) or a diffuse array of situations (anxiety). However, the underlying mechanisms are likely to be similar. These learning experiences will interact with the child's temperament, which could in turn shape the degree to which children generalize experiences about particular stimuli or situations (fear) to a broader range of stimuli/situations (anxiety).

When investigating the effects of cognitive biases on the development of fear in children, it is important to consider all characteristics of the fear emotion. According to Lang (1968) an emotion is made up of three response systems: (1) subjective states and cognitions associated with those states (verbal-cognitive responses); (2) behavioural changes; and (3) physiological states. This tripartite model is well established as a theoretical model and has also provided the backbone for a fairly recent development of treatment for child anxiety (Davis & Ollendick, 2005). Therefore, for any particular cognitive bias to be considered as important in the vulnerability of fear development in children, it must be able to explain how each of these components might be changed during the course of development.

## 1.4 Cognitive Characteristics of Anxious Individuals

### 1.4.1 *Attentional bias*

Although attentional bias will not be investigated in the current research, for completeness it is important to briefly review the role of attentional biases in adult and child anxiety. Attentional bias refers to the propensity of anxious individuals to pay more attention to potentially threatening environmental stimuli than non-anxious controls (see Bar-Haim et al., 2007 for a meta-analysis). Theoretical models of anxiety propose that this hypervigilance for threatening stimuli is the result of an over activation of normal responses to danger (e.g., Barlow, 2002). The presence of an attentional bias has been found in non-clinical individuals with high trait and/or state anxiety (e.g., Mogg et al., 2000). A large body of research has also found associations between anxiety and attentional bias in a range of anxiety disorders, for example: spider phobia (Watts, McKenna, Sharrock, & Trezise, 1986); generalized anxiety disorder (Bradley, Mogg, White, Groom, & de Bono, 1999; Mathews & MacLeod, 1985; Mogg, Mathews, & Weinman, 1989); obsessive-compulsive disorder (Tata, Leibowitz, Prunty, Cameron, & Pickering, 1996); posttraumatic stress disorder (Foa, Feske, Murdock, Kozak, & McCarthy, 1991); social phobia (Mattia, Heimberg, & Hope, 1993; Mogg & Bradley, 2002)); and panic disorder (McNally, Reimann, & Kim, 1990). Mathews and MacLeod (2002) and Mathews and Mackintosh (2000) have found that induced attentional biases can increase anxiety in previously non-anxious individuals.

The presence of an attentional bias has also been found in trait anxious children (Bijttebier, Vasey, & Braet, 2003; Schippell, Vasey, Cravens-Brown, & Bretveld, 2003; Vasey, Daleiden, Williams, & Brown, 1995); however, it remains unclear from where these biases come (Vasey & MacLeod, 2001). Developmental models of anxiety suggest that an attentional bias for threat-

related stimuli is a normal characteristic of young children but this bias decreases with age in normally developing children who learn to inhibit the automatic processing of potential threat, whereas anxious children do not develop this ability (Kindt, Bierman & Brosschot, 1997; Kindt & van den Hout, 2001). Kindt and van den Hout (2001) suggest that anxiety experienced during childhood creates a failure to inhibit selective attention to threat which, in turn, increases susceptibility to developing an anxiety disorder in adulthood. This hypothesis is also consistent with Lonigan's temperament model, which suggests that the development of effortful control (the ability to inhibit selective attention to threat) is important because it mediates the relationship between threat-related attentional bias and the beginning of an anxiety disorder (Lonigan, Vasey, Phillips & Hazen, 2004). For example, young children (aged 8) may lack adequate effortful control to suppress attentional reactions to threat-related stimuli or information that is relevant to their particular developmental stage causing them to become fearful (Nightingale, Field, & Kindt, 2010).

More recently, research has shown that an attentional bias can be created in normally developing children via a short burst of threat information about a novel animal (Field, 2006a) and that trait anxiety moderates this effect (Field, 2006b). This research suggests that environmental factors are likely to have a role in the development of attentional biases and children who are trait anxious are more susceptible to these environmental influences than non-trait anxious children. However, the underlying mechanism through which trait anxiety predicts the development of fear and attentional bias due to threat information is still unknown.

#### *1.4.2 Reasoning Biases*

Reasoning refers to the cognitive process involved in drawing conclusions, making judgements and testing hypotheses logically and reliably (Muris, 2010). This is an important characteristic of

human functioning because it facilitates the individual in understanding their internal and external environment. However, strong evidence suggests that in children suffering from anxiety disorders, reasoning is often erroneous and biased in a number of ways (see Muris, 2010).

For example, one such reasoning bias is known as reduced evidence for danger (RED) bias and predicts that individuals with anxiety problems tend to require less information before perceiving a situation as threatening (Muris, 2010). Evidence for the presence of RED bias in anxious youth was first provided by Muris, Merckelbach and Damsma (2000) who exposed a group of 8-13 year old non-clinical children to vignettes of social situations, which were presented to them in a piecemeal manner. The results indicated that children with high levels of social anxiety required fewer sentences before deciding that a story was going to be threatening relative to children with low levels of social anxiety (see also Muris, Kindt et al., 2000).

Another reasoning bias, termed emotional reasoning by Beck, Emery and Greenberg (1985), describes the fact that anxious individuals tend to infer danger from physical anxiety responses rather than from objective threat and as a result, false alarms are not recognised and anxiety tends to persist. So far, results have indicated that emotional reasoning is present in non-clinical children (e.g. Muris, Merckelbach & Van Spauwen, 2003) and that early manifestations of emotional reasoning seem to exist in children as young as 4 years old (e.g. Morren, Muris & Kindt, 2004; Muris, Vermeer & Horselenberg, 2008).

A distinct type of reasoning bias, known as covariation bias refers to the tendency of anxious individuals to more easily associate anxiety-related stimuli with negative outcomes (Mineka & Tomarken, 1989). In experiments with adults, anxious and non-anxious participants are shown a series of slides consisting of anxiety-relevant (e.g. spiders) and neutral (e.g. flowers) pictures.

Slide offset was followed by one of three outcomes, namely, an aversive shock (i.e. negative outcome), a tone or nothing. Despite the fact that fear-relevant and neutral pictures were equally often followed by each of the outcomes, anxious participants systematically overestimated the contingency between anxiety-relevant stimuli and negative outcomes (e.g. De Jong, Merckelbach & Arntz, 1995; Pauli, Montoya & Martz, 1996).

Unfortunately, due to the unethical nature of the experimental procedure (electrical shock), this bias has been more difficult to investigate in children (Muris, De Jong, Meesters, Waterreus, & Van Lubeck, 2005). One way in which researchers have overcome this issue is by employing a thought experiment, in which children are asked to *imagine* that they receive a mild electric shock after viewing some of the fear-relevant and neutral pictures. However, although studies by Muris, Huijding, Mayer, Den Breejen, and Makkellie (2007), and Field and Lawson (2008) have provided support for the presence of covariation bias in anxious youths, a study by Muris, De Jong et al., (2005) yielded somewhat disappointing results. Thus, it is apparent that more research is required to demonstrate that this type of reasoning bias operates in children with anxiety problems.

Probability bias is another type of reasoning bias that has been hypothesised to be present in anxious youths. This reasoning bias refers to the fact that anxious children have a tendency to estimate that future negative events are far more likely to occur, and in particular to themselves (Butler & Mathews, 1987). Probability bias in youths can be measured by means of the Subjective Probability Questionnaire (Dagleish et al., 1997), which simply asks children to estimate the likelihood that a given negative event will happen in the future. Of course, it is expected that anxious children will provide increased probability estimates of future negative events, and in particular for those events that may happen to themselves. However, the evidence

on probability bias in anxious youths is mixed. On the one hand, studies in non-clinical children and adolescents have provided support for the presence of this type of reasoning bias in youths (e.g., Canterbury et al. 2004; Muris & Van der Heiden, 2006); on the other hand, research in clinically referred anxious youths has generally yielded negative results. For example, Dalglish et al., (1997) examined the occurrence of probability bias in 9- to 18-year-old children and adolescents with anxiety disorders, depression, or no psychiatric disorder and found that neither anxious nor depressed youths estimated negative events to occur more frequently than did non-clinical youths. Thus, it has to be concluded that the evidence for an anxiety-related probability bias in children and adolescents is not very compelling. Nevertheless, Dalglish et al. (1997, 2000) have argued that such negative findings may be a result of inhibitory processes overshadowing the probability bias, and this may be particularly true in youths displaying high anxiety levels. Briefly, such inhibitory processes may reflect children and adolescents' strategy to minimize the likelihood that negative events will actually happen to them (i.e., 'strategic inhibition' hypothesis). Future research is necessary to test this hypothesis and to further explore the role of probability bias in anxious children and adolescents.

The reasoning bias of greatest interest to the current thesis is interpretation bias. This bias refers to the tendency of anxious individuals, relative to non-anxious controls to readily provide a threatening interpretation of ambiguous situations and stimuli (e.g., Eysenck, Mogg, May, Richards, & Mathews 1991; Mathews, Richards, & Eysenck, 1989; Richards and French, 1992). A large body of research has demonstrated an association between threat interpretation biases and panic disorder (e.g., Richards, Austin, & Alvarenga, 2001), social phobia (e.g., Hirsch & Mathews, 2000; Stopa & Clark, 2000; Voncken, Bögels, & de Vries, 2003) and generalised anxiety disorder (Hazlett-Stevens & Borkovec, 2004) (see Mathews & MacLeod, 2005, for

review). This interpretation bias could be important in maintaining anxiety in ambiguous situations in real life. In the study by Eysenck et al. (1991), clinically anxious, recovered clinically anxious, and non-anxious controls were presented with a mixture of unambiguous and ambiguous sentences. The ambiguous sentences could be interpreted in either a threatening or non-threatening manner (e.g., the doctor examined little Emma's growth). The key finding of this study was that in a subsequent recognition memory test, anxious participants were more likely than non-anxious controls and recovered anxious participants to disambiguate the sentences in a threatening rather than a non threatening manner; e.g., anxious participants were more likely to choose the sentence referring to Emma's tumour (threat) rather than her height (non threat) than the other two groups. Correct rejections of distracter sentences that were matched for valence but differed in meaning from the original suggests that these group variations in interpretation style most likely reflect differences in how the ambiguous sentence was originally encoded in memory (Mathews & Mackintosh, 2000)

With regard to the child literature, interpretation bias is one of the more widely researched of the cognitive biases. For example, Barrett, Rapee, Dadds, and Ryan (1996) employed a sample of anxiety disordered children, children with oppositional defiant disorder, and controls (all aged between 7 and 14 years). The children were presented with vignettes of ambiguous situations and asked what they thought was happening in each situation. Subsequently, children were presented with a choice of two possible neutral outcomes and two possible threatening outcomes and were asked to indicate which they believed was most likely to occur. Both anxious and oppositional children more frequently perceived ambiguous situations as threatening than did normal controls, with anxious children more often choosing avoidant outcomes and oppositional children more frequently choosing aggressive outcomes of the ambiguous situations. Similarly, other studies



that have used the ambiguous situation paradigm have found that anxious children are more likely than non-anxious children to interpret ambiguous or mildly unpleasant scenarios as more negative and dangerous, overestimate danger and underestimate their own coping skills, provide more avoidant solutions to ambiguous situations and make threatening conclusions based on less information (e.g. Bögels, van Dongen, & Muris, 2003; Bögels & Zigterman, 2000; Chorpita, Albano, & Barlow, 1996; Creswell, Schniering, & Rapee, 2005; Waters, Craske, Bergman, & Treanor, 2008)

Using a homophone paradigm, Hadwin, Frost, French, and Richards (1997) investigated interpretation bias in anxious and non-anxious children aged between 7 and 9 years. Anxiety levels were measured using the Revised Children's Manifest Anxiety Scale (RCMAS; Reynolds and Richmond, 1985) and children were then presented with homophones that had both a neutral and a threatening interpretation (e.g., dye versus die). The results demonstrated that children who were more anxious were significantly more likely to make threat interpretations of the homophones. In another study, Taghavi, Moradi, Neshat-Doost, Yule, and Dalglish (2000) presented 9-16 year olds with a set of homophones that were printed on cards. As in previous studies, each homophone had a threat interpretation and a non-threat interpretation with which it was associated. Participants were asked to compose a sentence containing the ambiguous word. Anxious children and adolescents formed significantly more sentences using the threatening interpretation of the homophone than did the non-anxious children.

The studies mentioned so far, together with others (e.g., Dineen & Hadwin, 2004; Suarez & Bell-Dolan, 2001) provide evidence that interpretation bias is a cognitive distortion, which is characteristic of both children and adults who are highly anxious and anxiety-disordered. Nevertheless, it cannot be inferred from these studies whether interpretation bias is a causal

factor in anxiety or whether anxiety (or vulnerability to anxiety) is the cause of a negative interpretation style, or alternatively, whether there is no direct causal link between anxiety and interpretation and both anxiety and interpretation style are the outcome of separate and unrelated processes (Mathews, Ridgeway, Cook & Yiend, 2007).

Direct evidence that interpretive bias can make a causal contribution to anxiety reactivity have come from interpretation bias training studies that have demonstrated that it is possible to experimentally manipulate interpretation bias through training and doing so affects state anxiety (e.g., Mathews & Mackintosh, 2000; Yiend, Mackintosh, & Mathews, 2005; Wilson, MacLeod, Mathews, & Rutherford, 2006;). More specifically, studies have shown that when these biases are trained in non-anxious adults, their state anxiety increases. For example, Mathews and Mackintosh (2000) presented participants with descriptions of ambiguous social situations, which were disambiguated only by the final word of the sentence. For half of the participants, this final word was consistent with emotionally negative outcomes and for the remainder this word was consistent with emotionally positive outcomes. Participants were required to complete this fragment, and answer a question designed to reinforce the designated emotional valence. The results revealed that training had been successful: participants in the threat interpretation bias training group responded significantly faster to negatively valenced fragments, whereas participants in the non-threat interpretation training group responded faster to positively valenced fragments. The crucial finding of this study was that when participants were subsequently asked to interpret a new set of ambiguous sentences, participants in the negative training group more frequently chose negative interpretations, whereas participants in the positive training group more often endorsed positive interpretations, suggesting that interpretation bias can be successfully manipulated by learning experiences. More important, state anxiety levels changed

congruent with the valence of the induced interpretation bias: state anxiety levels increased after negative and (non-significantly) decreased after positive interpretation bias induction. These findings suggest that the way ambiguous stimuli are interpreted has a causal effect on levels of state anxiety. However, increases in state anxiety were found only in participants who were required to actively generate meaning: namely, participants who had to complete the resolving fragment and subsequent question. In other conditions in which participants were presented with the same ambiguous descriptions but were not required to complete the final resolving word for themselves developed the same interpretative bias for new descriptions, but their anxiety levels did not change. These findings have since been replicated with the additional finding that the effects of training on interpretation biases can be maintained over 24 hours (Yiend et al., 2005).

In a more recent study, Wilson et al. (2006) used training procedures to induce interpretive biases favouring the threatening or nonthreatening meanings of ambiguous information in a sample of 48 undergraduate students. Subsequent to the training manipulation, emotional reactions to a stressful video were assessed and results revealed that the interpretation bias manipulation had successfully modified emotional reactivity (state anxiety). More specifically, only those participants who had received the threat training condition displayed a significant elevation of state anxiety in response to the stressful video, whereas the non-threat trained participants reported no significant state-anxiety response to the video clips. Taken together, these studies suggest that interpretation biases play a causal role in the development and maintenance of anxiety disorders as predicted by cognitive theories (e.g. Beck, Emery and Greenberg, 1985).

Unfortunately, there has been far less research conducted in the child literature and what has been done has also obtained inconsistent findings. Muris, Huijding, Mayer and Hameetman (2008) were the first to attempt to experimentally manipulate interpretation bias in children. They designed the “Space Odyssey” paradigm to train a sample of non-clinical children aged 8-12 years to (depending on which condition they were randomly assigned) develop either a negative or positive interpretation bias. This training paradigm consisted of 30 brief descriptions of events that could occur on a make believe planet. Each description was followed by two possible outcomes: one negative and one positive. Children were instructed to choose one of the possible outcomes and were subsequently presented with feedback on their choice. In the negative training condition, the choice of a negative outcome was reinforced, whereas in the positive training condition the choice of a positive outcome was reinforced. Subsequently, children were presented with a series of ambiguous sentences and their perceptions of threat were assessed. The results revealed that the training phase had been successful in inducing the designated interpretation bias and most importantly, children’s subsequent threat perception scores were affected in congruence with the training they received. Namely, children in the negative training condition displayed higher threat perception scores than children in the positive training condition. Moreover, children who were more vulnerable (exhibited high levels of anxiety symptoms) were especially affected by training.

Muris, Huijding, Mayer, Remmerswaal, and Vreden, (2009) subsequently replicated this study with the inclusion of a baseline measure of interpretation bias to investigate change in interpretation bias as a result of the experimental manipulation. Consistent with Muris, Huijding et al. (2008), they found that the experimental training was successful in influencing children’s interpretation biases in the predicted direction. However, the observed effect sizes were fairly

small, and inconsistent with Muris, Huijding et al., (2008), high-anxious children were not significantly more affected by the experimental manipulation than low-anxious children. Moreover, no evidence was found to support the idea that distorted cognition underlies child anxiety problems because the change in interpretation bias was not significantly associated with change in avoidance tendencies. Lester, Field and Muris (2010a) also failed to find significant differential effects of interpretation bias modification on state anxiety in children aged 7-15 years. These findings are inconsistent with the adult literature (e.g. Mathews and Macintosh, 2000), which has reported that change in interpretation bias leads to a change in state anxiety levels.

Nonetheless, other studies have reported significant effects of interpretation bias training on levels of anxiety in children. For example, in a similar study to that of Lester et al. (2010a), Lester, Field and Muris (2010b) found preliminary evidence that interpretation bias modification *was* capable of directly evoking modification congruent changes in self-report state anxiety in a sample of children (6-11 years). Specifically, they found that anxiety increased significantly across negative modification and decreased non-significantly across positive modification. Vassilopoulos, Banerjee and Prantzalou (2009) also found significant effects of interpretation bias modification on anxiety levels in a sample of highly socially anxious children aged 10-11 years. Specifically, their results revealed that the interpretation training sessions not only reduced threatening interpretations but also reduced social anxiety, and were found to last a minimum of three days following the completion of the training. These findings are consistent with existing theoretical and empirical models, which hypothesise that interpretation biases play a causal role in vulnerability to anxiety by impacting on how ambiguous situations and events are processed (see Clark & Wells, 1995; Rapee & Heimberg, 1997).

It would seem that the majority of experiments in this area have not only provided support for the notion that childhood anxiety is associated with a bias towards making threat interpretations of ambiguous scenarios but additionally, interpretation bias training studies have suggested that anxiety vulnerability may be attributable, at least in part, to threat-relevant interpretive biases. In other words, a threat related interpretation bias causes anxiety. However, little is known about how interpretation biases affect learning about novel ambiguous stimuli. For instance, investigations into interpretation biases in children thus far, have focused on interpretation of ambiguous situations, stories and homophones, all of which children are likely to have had some experience with. The current experiments, therefore, aim to extend previous research by investigating how interpretation biases affect learning about new, potentially threatening stimuli to give some indication of how interpretation biases feed into learning.

#### *1.4.3 Memory Bias*

Information-processing models of emotional disorders propose that anxious individuals are characterized by a memory bias for threat-relevant information. Memory bias is conceptualized as a propensity to selectively remember information congruent with an emotional state. In anxiety this would entail recall of memories congruent with the cause of anxiety, which ultimately leads to a biased explanation of ambiguous situations (Muris & Field, 2008).

A large body of experimental research has investigated the association between anxiety and selective memory for threatening information. However, in contrast to findings on attentional and interpretational bias, the findings on memory bias have been mostly contradictory. As Coles and Heimberg (2002) wrote in their extensive review of the literature, inconsistent findings make it difficult to come to satisfactory conclusions. More recently, Mitte (2008) conducted a meta-analysis on the memory bias and anxiety literature and found no overall relationship between

anxiety and implicit memory for threat-related information: the effect sizes did not differ significantly either between high-anxious and low-anxious individuals or between primed and un-primed material. For example, in experiments in which participants have been presented with briefly flashed stimulus words (such as *weapon*) and asked to decide whether it is a meaningful word or not, or asked to complete the word stem *wea*\_\_\_\_ with the first word that comes to mind, their choices have not been found to vary as a function of trait anxiety: all participants, both low and high trait anxious perform equally well. On the other hand, across all studies which have investigated the relationship between anxiety and memory recall for positively and negatively valenced stimuli, the between-groups effect sizes imply that high-anxious individuals relative to low anxious individuals show enhanced recall for threatening material ( $g = -0.11$ ) and poorer recall for positive material ( $g = 0.19$ ). Although the main effect sizes are small, the difference between the two effects sizes is moderate in size, indicating that the simultaneous consideration of positively and negatively valenced stimuli may be relevant for anxiety. That is, the between-groups effect sizes suggested a slight tendency for high-anxious individuals to preferentially process negative stimuli and a slight tendency for low-anxious individuals to preferentially process positive stimuli.

Despite the lack of evidence in support of memory biases in anxious individuals, there is currently a large body of evidence indicating the presence of a memory bias in individuals suffering from depression (see Williams, 1997, 2001). Specifically, in a study looking at memories of negatively and positively valenced word lists, Bradley and Mathews (1983) found that compared with non-depressed controls, depressed participants remembered a greater number of negative adjectives relative to positive adjectives. With regards to more personally relevant material, Williams (1997, 2001) found that depressed individuals show a greater latency to

retrieve positive life events from memory than non-depressed individuals; however, they are not much faster than non-depressed controls at retrieving negative events. This finding suggests that it is not so much the presence of negative memories that increases an individual's risk for depression but it is the *lack* of positive memories that is important.

Research also suggests that depressed individuals have difficulties in remembering specific episodes from their autobiographical memory (see Williams et al., 2007 for a review). For example, when asked to recall a specific time of feeling happy or sad, depressed people, relative to non depressed controls, showed a tendency to respond with more categorical rather than specific memories and generalise across similar events (e.g., “the times I’ve been hurt by other people” vs. “that very Friday evening when my partner told me she was seeing somebody else”) (Raes, Verstraeten, Bijttebier, Vasey & Dalgleish 2010). This phenomenon is known as over general memory (OGM) and has also been found to be present in depressed children (Drummond, Dritschel, Astell, O’Carroll, & Dalgleish, 2006; Reas, et al., 2010; Vrielynck, Deplus & Philippot, 2007).

Although the current study is looking at anxiety and not depression, extensive research has shown that there is a large overlap in the symptoms of anxiety and depression in both adult and youth populations (Clark & Watson, 1991; Mineka, Watson, & Clark, 1998; Seligman and Ollendick, 1998). This is evidenced by high correlations between self-report measures of anxiety and depression, with coefficients typically in the  $r = .45$  to  $.75$  range in adults (Clark & Watson, 1991) and in the  $.50$  to  $.70$  range in children (Brady & Kendall, 1992) and by high rates of comorbidity between anxiety and depressive disorders (e.g., Brady & Kendall, 1992). Overlap of items on self-report measures of anxiety and depression accounts for only a small proportion of the shared variance between them (Seligman & Ollendick, 1998; Stark & Laurent, 2001, Cole,



Truglio & Peeke, 1997). Clark and Watson (1991) proposed a tripartite model to account for the large proportion of unexplained shared variance and comorbidity between anxiety and depression. This model posits that anxiety and depression share the same underlying construct: negative affect (NA), which represents the extent to which an individual feels upset or unpleasantly engaged, rather than peaceful. Watson (2005) has since argued that the identification of this higher order dimension— negative affectivity — has particularly important implications for DSM-V, because it suggests that these disorders should be linked together into a more general category of distress related syndromes rather than remaining as entirely distinct diagnostic classes. Hence it would seem that the aforementioned literature indicating that memory biases are present in depressed individuals has some bearing on anxiety potentially.

Despite the potential importance of memory biases in maintaining adult anxiety and depression, little is known about how these biases develop. There have been relatively few investigations on this issue in the child anxiety literature and what has been done has provided mixed results (see Muris & Field, 2008, for a review). For example, Moradi, Taghavi, Neshat-Doost, Yule, and Dalgleish (2000) found modest evidence for a memory bias in a group of 9 to 17 year olds who were instructed to learn groups of words from three categories (negative, positive and neutral). During a free recall task, children with a diagnosis of Post-Traumatic Stress Disorder (PTSD) and control children did not differ with respect to recall of negative words; however, it was found that youths with PTSD recalled relatively more negative words relative to positive and neutral words than control youths. Using the same methodology, Dalgleish, et al., (2003) looked at a clinical group of 7- to 18-year-old youths with PTSD or Generalized Anxiety Disorder (GAD) and found no differences relative to controls in a free-recall test. Watts and Weems (2006) found that a memory bias score correlated significantly with child and parent-reported

anxiety scores, although the magnitudes of the correlations were modest ( $r = .23$  and  $r = .26$ , respectively). Finally, Daleiden (1998) found that a memory bias was present in high trait anxious children for negative words but only in tasks that required processing of the meaning of the stimuli.

This brief overview of research on anxiety-related memory bias in children and adolescents tentatively suggests that there may be biases for recalling threat memories in anxious children and adolescents. However, it also highlights the current lack of clear evidence for this type of cognitive distortion in youths and shows that more work is needed. For example, it also remains unclear whether biased memory increases feelings of fear and anxiety; the current research will address this issue.

#### *1.4.4 Cognitive Rehearsal*

Repetitive, prolonged, and recurrent thought about one's self, one's concerns and one's experiences is a cognitive process frequently engaged in by anxious individuals (Harvey, Watkins, Mansell, & Shafran, 2004) and may even play a part in the aetiology of anxiety. For example, Mor and Winquist (2002) conducted a meta-analysis and found that cognitive rehearsal about threat creates anxiety. Examples of such repetitive thinking include worry, rumination, emotional processing, mental simulation, cognitive processes, rehearsal, reflection, repetitive thought and problem solving (e.g., Martin & Tesser, 1996; Mor & Winquist, 2002; Papageorgiou & Wells, 2004; Wyer, 1996). Across these constructs, there are substantial similarities and overlap in theoretical conceptualizations and functional definitions (Watkins, 2008). Moreover, Field and Cartwright-Hatton (2008) showed that various forms of 'negative iterative thinking' i.e. rumination, worry, interpretation of intrusions, obsessive beliefs and shame could best be represented as indicators of a common cognitive process when predicting social anxiety. For

these reasons and particularly in the interest of avoiding unnecessary confusion, the term cognitive rehearsal (CR) will be used throughout this thesis to symbolize all the constructs listed above. The term cognitive rehearsal will be used in preference to other labels because it is a broader and more inclusive term and it is less likely to cause confusion than terms such as rumination and worry which both already have multiple conceptualizations and meanings.

Despite the current lack of research on cognitive rehearsal in the child anxiety literature, the research that is available indicates that this pattern of negative repetitive thought is present in anxious youth (Comer, Kendall, Franklin, Hudson, & Pimental, 2004; Hodson, McManus, Clark, & Doll, 2008) and has been shown to be associated with poor problem solving skills, impaired motivation, and inhibition of instrumental behaviour (see Lyubomirsky & Tkach, 2004 for a review) and therefore, it is not surprising that cognitive rehearsal has been found to play a role in the strengthening and maintenance of anxious states (Rector, Antony, Laposa, Kocovski & Swinson, 2008)

Negative cognitive rehearsal is considered to be an unconstructive and maladaptive thought process in the sense that it is believed to act to inflate an individual's aversive evaluation of an aversive outcome (Davey & Matchett, 1994). This idea fits with evidence from conditioning (*see* Field, 2006c) that suggests that following a traumatic episode in which an association has been established between a novel stimulus (CS) and an aversive outcome (US), subsequent presentations of the CS alone often results in an inflated fear response (CR) even though the aversive US is no longer present. This phenomenon is known as incubation, and negative cognitive rehearsal is believed to be one likely explanation for its occurrence (Davey, 1992). For example, research has shown that following a traumatic episode, many individuals engage in negative cognitive rehearsal of the traumatic US (Marks, 1987) and Davey (1992) has argued

that this negative cognitive rehearsal could act to inflate and refine the aversive mental representation of the US that is evoked by future encounters with the CS causing an increased fear response.

In a laboratory experiment with adults, Jones and Davey (1990) presented participants with pairings of a CS (a triangle) and an aversive US (loud tone) in combination with presentations of a different CS (a kitchen tap), which was never paired with a US. Once differential conditioned fear had been established, participants were divided into three groups: participants in the first group were asked to think about the US (loud tone) whenever the word ‘think’ was present on the VDU screen and to imagine this tone and their reactions to it as vividly as they could. In the second group, participants were given the same instructions, only instead of thinking about the loud tone they were instructed to think about an irrelevant aversive event. Finally, in the third group, participants were again presented with the same instructions except they were instructed to think about an irrelevant benign event. Participants in all three groups completed six of these cued cognitive rehearsal (thinking) trials with a 10 second interval between each trial. The cue-word ‘think’ was present for 6 seconds on each trial. Subsequently, participants were given test presentations of both CS+ and CS- alone. The results revealed that rehearsal of the aversive US produced a fear response CR during testing which was slightly stronger than that established during conditioning. On the other hand, participants who rehearsed either the irrelevant aversive event or the irrelevant benign event showed no change in CR during testing. These results suggest that cognitive rehearsal of the US is indeed sufficient to prevent extinction of the conditioned fear response CR, and in some circumstances it can increase it (Davey, 1989).

## 1.5 Temperament and Anxiety

Evidence suggests that temperament factors play a significant role in the development and maintenance of anxiety pathology (for reviews see Frick 2004; Nigg 2006) particularly with regard to the broad temperament construct of trait anxiety and risk for the development of anxiety and depression (e.g., Clark, Watson & Mineka, 1994; Compas, Connor-Smith & Jaser, 2004; Derryberry & Rothbart 1997; Lonigan, Vasey, Phillips, & Hazen, 2004). At one time theoretical, this relationship is now well established experimentally both cross-sectionally (e.g., Anthony, Lonigan, Hooe & Phillips, 2002; Eisenberg et al. 2001; John, Caspi, Robins, Moffitt & Stouthamer-Loeber, 1994; Lonigan, Hooe, David & Kistner, 1999; Muris 2006; Muris, Bodden, Merckelbach, Ollendick, & King, 2003; Muris, Roelofs, Meesters & Boomsma, 2004; Muris, Meesters & Blijlevens, 2007) and longitudinally (e.g., Biederman et al. 2001; Caspi, Henry, McGee, Moffitt, & Silva, 1995; Eisenberg et al. 2005; Hirshfeld et al. 1992; Kagan, Snidman, Zentner & Peterson, 1999; Lonigan, Phillips & Hooe, 2003; Prior, Smart, Sanson & Oberklaid, 2000; Rende, 1993).

Gray (1987) proposed that the dimension of trait anxiety is underpinned by a neural system circuit, or set of circuits known as the behavioural inhibition system (BIS) and its anatomical substrate, known as the septo-hippocampal system, which is believed to control the experience of anxiety in response to anxiety provoking stimuli. The BIS is activated by warnings of punishment or non-reward, novel stimuli and innate fear stimuli, its outputs being the inhibition of ongoing motor behaviour, an increased level of arousal and increased attention. Gray (1982) also proposed that the BIS mediates individual differences in trait anxiety. Anxious individuals and patients with generalized anxiety disorder would have an overactive BIS (Gray, 1982), whereas low anxiety subjects and primary psychopaths would be characterized by an underactive

BIS (Fowles, 1980). The BIS construct is then related to a dimension that comprises inhibitory as well as disinhibitory disorders.

The belief that the BIS underpins a core temperamental trait significant in the development of fear re-emerges throughout the literature and has been conceptualized in different ways: For example, Tellegen (1985) proposed a personality dimension *negative emotionality*, which corresponds to both anxiety (in terms of responses to stress) and the BIS. However, Clark and Watson (1991) have termed negative emotionality, *negative affect* in their more recent tripartite model. Rothbart, Ahadi, and Evans (2000) have proposed *fear* to be one of four core temperaments in childhood, and that this temperamental trait is underpinned by the BIS. On the other hand, however, developmental models of anxiety have identified *neuroticism–negative affect* (and *trait anxiety*, which is a strong correlate of NA/N) to be underpinned by the BIS. Although on the face of it confusing, evidence suggests that these dimensions show a high degree of convergence with one another (see Nigg, 2006, for a review) and can therefore be distilled into one temperament construct. In keeping with Gray and McNaughton's (2003) terminology, this temperament will be termed *trait anxiety* throughout this thesis and will be used as a predictor of fear acquisition because it is thought that children scoring high on this personality characteristic will be in a more general state of physiological arousal and therefore more prone to acquiring fear in a given learning episode than children who are less trait anxious.

For example, recent research has found that child reported trait anxiety moderates the relationship between threat information and fear development (Field 2006b; Field & Price-Evans, 2009). Specifically, children high on trait anxiety have shown greater avoidance, attentional bias and physiological arousal (fear) towards previously novel animals after experiencing threat information about them.

***Hypothesis 1:*** *The starting point of my thesis is, therefore, that **trait anxiety will predict fear responses to potentially threatening verbal information**. The remaining hypotheses look at how different forms of cognitive processing influence this relationship.*

## **1.6 Interactions between Trait Anxiety and the Cognitive Biases**

Although evidence has highlighted the importance of trait anxiety in the development and maintenance of anxiety pathology, the mechanisms underlying this relationship remain inadequately understood (Lonigan et al. 2004). Lonigan et al. (2004) have suggested that one potential underlying mechanism that may explain the relationship between temperament and anxiety refers to attentional biases towards threat, which have been demonstrated in anxious children and adults (see Vasey & MacKeod, 2001, for a review or see attentional bias section above). Specifically, they suggest that the relationship between Negative affect/ Neuroticism NA/N (i.e. trait anxiety) and risk for elevated levels of anxiety is in part mediated by an attentional bias towards potentially threatening stimuli in the environment and that this risk is moderated by a temperamental process known as effortful control, which acts to override the urge to attend to threat cues in the environment.

Lonigan and Vasey (2009) have recently provided some support for this model. For example, in a sample of 104 children (specially selected because they reported high or low levels of trait anxiety and EC), they found that EC moderates the relationship between trait anxiety and attentional bias; only children with low levels of EC and high levels of trait anxiety showed an attentional bias towards threat during a dot probe detection task. It is important to note nonetheless, that these results only provide support for part of Lonigan et al.'s (2004) model and the hypothesis that an attentional bias towards threat mediates the relationship between trait anxiety and later anxiety still remains to be tested. However, studies of children and adults have found a link between high levels of trait anxiety and an attentional bias toward threat cues (see

Bar-Haim et al., 2007 for a comprehensive review) and between an attentional bias and anxiety pathology in children (e.g., Dalglish et al. 2003; Vasey et al. 1995; Watts & Weems 2006) and adults (MacLeod et al. 1986; Mogg et al. 1992; Mogg et al. 1989) and therefore, it seems highly likely that an attentional bias towards threat may mediate the relationship between trait anxiety and later anxiety/fear.

Based on this argument, attentional bias is only one potential mechanism through which trait anxiety might lead to fear. Other biases related to attentional bias might also mediate this relationship such as interpretation biases. For example, according to Mathews and Mackintosh (1998), the mechanisms underlying attentional bias and interpretation biases are the same, i.e. they both involve competition of cognitive resources. Mathews and Mackintosh's (1998) model argues that attention gained by one stimulus decreases attention to the other through inhibitory connections. If a stimulus corresponds to stored information associated with threat, it will receive greater activation from the TES and, therefore, greater attention (and increased sensations of anxiety). The theory behind interpretation bias is much the same in that when faced with ambiguity, it has been argued that the threat evaluation system TES encourages the activation of threat meanings while the positive evaluation system PES encourages the activation of non threat meanings. At the same time activation of one meaning tends to inhibit activation of the other, so interpretation is pulled in one direction or the other, depending on how well the ambiguous stimulus corresponds to stored representations in the TES and PES (Mathews & Mackintosh, 1998). Due to these similarities between interpretation bias and attentional bias, it seems likely, based on Lonigan et al.'s (2004) model, that the relationship between trait anxiety and fear, as well as being mediated by a threat attention bias is also mediated by a threat interpretation bias.



***Hypothesis 2:*** *Given that Interpretation biases have the same underlying mechanisms as attention biases, they should mediate the relationship between trait anxiety and fear.*

There is also good reason to speculate that cognitive rehearsal mediates the relationship between trait anxiety and fear. For instance, reflecting back to the section on cognitive rehearsal (p.15), evidence suggests that this type of repetitive thought about one's self, one's concerns and one's experiences is characteristic of both trait anxious adults (Harvey, Watkins, Mansell, & Shafran, 2004) and children (Comer, Kendall, Franklin, Hudson, & Pimental, 2004; Hodson, McManus, Clark, & Doll, 2008) and in addition, it has been argued that cognitive rehearsal may play a part in the etiology of anxiety problems: for example, a meta-analysis of the literature found that cognitive rehearsal about threat creates anxiety (Mor & Winquist, 2002). Therefore, it could also be predicted that cognitive rehearsal mediates the relationship between trait anxiety and fear.

***Hypothesis 3:*** *Given that negative cognitive rehearsal is characteristic of anxious individuals and is believed to play a part in the etiology of anxiety, it should mediate the relationship between trait anxiety and fear.*

### **1.7 Interactions Between Interpretation bias and Memory bias**

Thus far, the cognitive biases have each been discussed separately, however, it is unlikely that they operate in isolation. Recently, Muris and Field, (2008) have proposed a comprehensive model of information processing in which they suggest that the cognitive biases are linked and interact with each other at different stages of information processing and impact on feelings of fear and anxiety. For example, the model suggests that when confronted with potential threat, novelty or ambiguity, anxious children tend to shift their attention towards any potentially threatening stimuli (i.e., attention bias). Subsequently, during the interpretation stage, anxious youths have a tendency to ascribe a threatening meaning to ambiguous stimuli (i.e., interpretation bias), this threatening meaning is then encoded into memory, resulting in a greater memory for information concerning danger (i.e. memory bias); thus, for children who are high trait anxious,

ambiguous situations are readily evaluated as dangerous. The model also posits that this biased information processing brings forth feelings of fear and anxiety, which in turn boost the frequency of cognitive biases and may reinforce the maladaptive vulnerability and danger schemas. Based on this model, it could be predicted that when faced with ambiguity, interpretation bias should predict memory bias, which in turn should lead to an increased fear response and this relationship should be stronger for children who are highly trait anxious than for children who are less trait anxious.

Evidence for such connections between interpretation bias and memory come from the aforementioned study by Eysenck et al., (1991) in which it was found that in a recognition memory test, non-anxious participants were more likely to remember previously heard ambiguous sentences as having a benign meaning, whereas currently anxious patients were equally as likely to remember the ambiguous sentences as having either a threatening or a benign meaning. Most relevant here, is that participants correctly rejected valence-matched distracter sentences indicating that the group differences found were likely to reflect variations in how the original ambiguity had been encoded into memory.

***Hypothesis 4:*** *Given that cognitive biases at early stages of information processing are thought to impact on subsequent stages, and that these biases are more likely to be present in high trait-anxious than low-trait anxious individuals, it is predicted that threat interpretation biases should predict biased memory encoding and this relationship should be moderated by trait anxiety.*

***Hypothesis 5:*** *Based on Hypothesis 4, given that the cognitive biases interact at different stages of information processing leading to increased feelings of fear and anxiety, it is predicted that memory bias should mediate the relationship between interpretation bias and fear.*

## 1.8 Ethics

Employing children in any research project raises ethical issues. Likewise, the use of material that is fear-relevant elevates the need for sensitive handling of participants and careful consideration of their needs. Bearing in mind these considerations, the ethical aspects of this research have been given substantial attention, and it is believed that the designed protocol meets and exceeds current British Psychological Society and American Psychological Society ethical standards, and will not infringe the rights of any participant.

All of the procedures used have been used before in published research and/or have been used at the University of Sussex and have been through a local ethics committee. This includes the use of fear information about novel animals (e.g. Field, & Lawson, 2003), the touch box task (e.g. Field, & Lawson, 2003; Field, 2006a; Askew & Field, 2007) and the nature reserve task (Field & Stoulsen-Coulsen, 2007). The main issues relating to the British Psychological Society and American Psychological Society ethical standards are:

1. *Deception*: In all the experiments children will receive inaccurate ambiguous information about an animal. However, children will be given correct information as soon as possible and so the deception is short lived.
2. *Use of a heart rate monitor*: The children will be required to wear a heart rate monitor in experiment 3. However, the monitor only requires to be clipped to the children's ear. The female experimenter will demonstrate how to attach the ear clip before asking the child to do so themselves. This procedure has been approved by the dept. ethics committee for use with a more invasive heart rate monitor in 2006.

It is worth noting that the children in these experiments are not expected to acquire persistent fears. Rather the aim of this research is to show short-term changes in beliefs and behaviours about novel animals. There is no evidence from over 30 experiments using similar procedures that children acquire fears as a result of verbal information. Additionally, extensive debriefing and activity sheets will be provided to the children after the experiments (see appendix C) that have been successfully used in similar research. Also, parental consent for child participation will be collected before any child is tested. Finally, children will be fully informed that they can withdraw at any point they wish to do so.

The children will not be at risk. All procedures have been used before in child samples (that include this age range) and will not cause any physical or psychological harm. Children typically enjoy these experiments and through our debriefing activity sheets (see Appendix C) they learn about some animals that they are not taught about in the normal course of school activities.

Ethical approval was obtained by the University of Sussex, School of Life Sciences ethics committee before conducting any of the experiments described in this thesis (see appendix F).

## **2 Experiment 1: Do Highly Trait Anxious Children Naturally Cognitively Rehearse Ambiguous Information?**

### **2.1 Introduction**

It is well established that verbal threat information is sufficient to increase fear beliefs and avoidance towards novel animals in children (Field, Argyris & Knowles, 2001; Field, 2006a, 2006b; Field & Lawson, 2003; Muris, Bodden, Merckelbach, Ollendick & King, 2003).

However, it is unclear how these effects link to clinical phenomenology. There are several well-established clinical phenomena seen in anxious children such as cognitive rehearsal, memory bias and interpretation bias (Harvey et al., 2004), which could interact with the verbal information pathway to fear.

Child reported trait anxiety has been found to moderate the effect that verbal threat information has on the fear emotion (Field 2006b; Field & Price-Evans, 2009). Specifically children high on trait anxiety show greater avoidance, attentional bias and physiological arousal towards previously novel animals after hearing threat information about them. However, the question of why trait anxiety facilitates the effect of threat information on fear remains unanswered. The likely explanation is that the cognitive processes associated with trait anxiety influence how that information is interpreted, elaborated and stored in memory. For example, anxious individuals tend to have repetitive thought processes such as rumination and worry (Harvey et al., 2004; Marks, 1987) and a memory bias for threat information (Muris & Field, 2008).

Repetitively thinking about negative experiences inflates the effect of those experiences (Davey & Matchett, 1994). This tendency to cognitively rehearse information has also been found to be present in anxious children (Hodson, McManus, Clark, & Doll, 2008) and may act to inflate their

aversive evaluation of the aversive outcome; This idea fits with evidence from conditioning (*see* Field, 2006c) which suggests that once an association has been established between a novel stimulus (CS) and an aversive outcome (US), cognitive rehearsal of the US affects the representation of the US that is evoked by the CS. Additionally, Field (2006c) argues that threat information operates via basic associative learning systems such that threat information about a stimulus evokes a pre-existing conceptual representation of threat that becomes associated with that stimulus. Furthermore, threat information has the power to create or change that representation. So, it is not that thinking about the threat information makes it more aversive *per se*, but that thinking about it inflates the aversiveness of the representation of threat that it evokes. In other words, it is possible that the relationship between trait anxiety and the effect of verbal threat information is driven by the way the child interprets the information (i.e., trait anxious children dwell more on the threat information and in doing so derive more negative meaning from it).

It is also possible that trait anxious children selectively focus on and remember threat information to a greater extent than non anxious children, leading anxious children to become more sensitive to the effects of threat information (Muris & Field, 2008). The investigation of memory biases has been a focal point of research on the cognitive processing of emotional information in the adult literature; however, there have been relatively few investigations on this issue in the child anxiety and depression literature and the studies which have been done have had mixed findings. For example, Moradi, Taghavi, Neshat-Doost, Yule, and Dalgleish (2000) found evidence for the presence of a memory bias in children suffering from PTSD. However, using the same methodology, Dalgleish et al. (2003) found no significant differences between children with PTSD or GAD relative to controls. Watts and Weems (2006) found that a memory

bias score correlated significantly with child- and parent-reported anxiety scores, although the magnitudes of the correlations were not huge ( $r = .23$  and  $r = .26$ , respectively). Finally, Daleiden (1998) found that a memory bias was present in high trait anxious children.

Another of the cognitive biases, known as ‘interpretation bias’ is one of the more widely researched of the cognitive biases, at least in terms of the child literature, and refers to the phenomenon that anxious individuals show a propensity to interpret ambiguity in a threatening way (*see* Hadwin and Field, 2010, for a review). For example, Hadwin et al. (1997) utilized a homophone paradigm to investigate interpretation bias in anxious and non-anxious children aged between 7 and 9 years. Anxiety levels were measured using the Revised Children's Manifest Anxiety Scale (RCMAS; Reynolds & Richmond, 1985) and children were presented with homophones that had both a neutral and a threatening interpretation (e.g., dye versus die). The results demonstrated that children who were more anxious were significantly more likely to make threat interpretations of the homophones.

In another study, Taghavi, et al., (2000) presented 9-16 year olds with a set of homophones that were printed on cards. As in previous studies, each homophone had a threat interpretation and a non-threat interpretation associated with it. Participants were asked to compose a sentence containing the ambiguous word. Anxious children and adolescents formed significantly more sentences using the threatening interpretation of the homophone than the non-anxious children. These studies, together with others (e.g., Rapee et al., 1996; Bögels et al., 2000; Chorpita, et al., 1996; Dineen et al., 2004) indicate that interpretation bias is a cognitive distortion that is characteristic of children who are high-anxious and anxiety-disordered.

Muris and Field (2008) proposed a theoretical framework for understanding how cognitive biases interact and impact on the processing of threat-related information. Based on Kendall (1985) and Daleiden and Vasey's (1997) models, they suggest that different cognitive biases occur at different stages of information processing. For example, during the early encoding stage, anxious children appear to focus their attention towards potentially threatening stimuli (i.e., attention bias). Further, during the interpretation stage, anxious youths tend to disambiguate stimuli as threatening (i.e., interpretation bias) and exhibit an enhanced memory for information relating to danger (i.e., memory bias) resulting in anxious children readily evaluating situations as dangerous.

This theoretical model suggests that the cognitive biases are linked and may interact with each other at different stages of information processing and impact on feelings of fear and anxiety. In other words, distortions at an early stage of processing (e.g., encoding) increase the likelihood of biases at subsequent stages of processing (e.g., interpretation) (Daleiden & Vasey, 1997). It seems logical therefore that once attention has been captured by an ambiguous stimulus and interpreted as being threatening, the stimulus is then likely to be encoded into memory as being more threatening than it was in reality. Conversely, Dalglish et al. (2003) found quite a degree of discrepancy on tests measuring attentional, memory, and probability bias in clinically anxious youths, thus implying that distortion at one stage of information processing is not necessarily associated to the presence of a cognitive bias at another stage. However, this finding may be due to the psychometric qualities (i.e., reliability, validity) of the tests administered to measure the various types of information-processing biases. Watts and Weems (2006) found only limited support for significant interrelations amongst the cognitive biases. However, these studies both investigated links between the cognitive biases in a very general way. For example, each



measure used was unrelated to all the others; there was no consistency in content between the tasks used to measure the different cognitive distortions, as they each involved different situations. The current study aims to use a superior and more concise method for investigating the interrelations amongst cognitive biases, specifically by employing one single, well-defined experience and measuring participant's interpretation and memory of that experience.

The primary aim was to establish how children naturally think about ambiguous information about some novel animals (a quoll and a cuscus) and whether how they think about that information varies as a function of trait anxiety. Looking at conditioning research (Field, 2006c); we might expect children who are highly trait anxious to have a natural tendency to cognitively rehearse ambiguous information, leading them to dwell on the information and derive more threatening meaning from it resulting in an increase of fear towards the animals. In addition, this experiment was designed to look at whether children who are more trait anxious are more likely to interpret ambiguous information as threatening (interpretation bias) and thus remember the information as being more threatening (memory bias) than children who are less trait anxious. Finally, this experiment aims to investigate how these cognitive biases might interact with each other and with trait anxiety and their resulting impact on fear and avoidance of the animals.

Five main hypotheses arise from the theory just discussed. (1) Replicating Field (2006b), children who are more trait anxious, relative to children who are less trait anxious, would become more fearful of a novel animal after hearing some ambiguous information about it. (2) Because children who are more trait anxious have been found to disambiguate ambiguous information as more threatening (Field, 2006b), the relationship between trait anxiety and fear should be mediated by interpretation bias. In other words, children who are more trait anxious would interpret the information as being more threatening and therefore become more fearful of

the animals. (3) The relationship between trait anxiety and fear should also be mediated by how children think about the information: children who are more trait anxious are predicted to cognitively rehearse the ambiguous information and in doing so derive a more negative meaning from it, leading them to become more fearful of the animals. (4) Children who disambiguate the verbal information in a threatening way (interpretation bias) would subsequently encode the information more negatively into memory and therefore show a memory bias for the information and this relationship would be moderated by trait anxiety. In other words, the relationship between interpretation and memory would be stronger for highly trait anxious children than for less trait anxious children. (5) Finally it is predicted that memory will mediate the relationship between interpretation bias and fear: children who interpret the information as being more threatening would also encode the information as being more threatening into memory which would lead to them becoming more fearful of the animals.

## **2.2 Method**

### *2.2.1 Design*

Two different animals were used in this experiment about which children in the UK have no prior experience (both are Australian marsupials): a Quoll and a Cuscus. Information was manipulated so that children heard some ambiguous information about one of the animals and no information about the other animal (counterbalanced across groups). Natural levels of cognitive rehearsal were measured by a score of the severity of animal thoughts, which could range from 0 (severe negative thought) to 5 (severe positive thought). The outcome variables were: fear beliefs (Fear Beliefs Questionnaire (FBQ)) and avoidance (Nature Reserve Task (NRT) both measured before the information was given and after the information and cognitive rehearsal phases of the experiment; behavioural avoidance (measured using a Behavioural Approach Task), memory of

the information (measured using a free recall task and prompted memory questions), interpretation of the ambiguous information (measured using both forced choice and free response questions). Trait anxiety was measured as a predictor using the State Trait Anxiety Inventory for Children (STAI-C; Spielberger, 1973). All tasks and questionnaires are described below.

### 2.2.2 *Participants*

Fifty-five children (31 boys, 24 girls) between the ages of 8 and 11 years ( $M = 112.71$  months,  $SD = 10.02$ ) took part. A lower age limit of 8 years was selected because to participate, children needed to be able to describe their thoughts and anticipate their actions well enough to respond accurately to the measures being administered (Vasey, Crnic, & Carter, 1994). An additional reason for choosing this age range is that normative fears are focused on animals during this period (Field and Davey, 2001). Parents of children in years four (8-9 years), five (9-10 years) and six (10-11 years) were sent letters (see appendix A) describing the procedures used in the experiment (but not the main purpose) along with a consent form (see appendix B) to return to the school if they would like their child to participate (the experiment ran strictly on an opt-in basis only). A total of 150 children were invited to participate, giving a response rate of 36.7%. At the start of the testing session, children were reminded that they could withdraw at anytime. The children were enrolled from a school in a socially deprived designated regeneration area in Worthing, West Sussex. Most pupils were of white British or mixed backgrounds. Approximately four per cent were from other backgrounds, mostly from Bangladesh and India.

### 2.2.3 *Materials*

*Animals:* Pictures of two Australian marsupials were used: the cuscus and the quoll (see Field & Lawson, 2003; Field, 2006a, 2006c; Field & Storksén-Coulson, 2007). These animals were used because they are novel to most children in the UK. This novelty ensured that the children had no previous encounters with either of the animals and no prior fear beliefs towards them. No children expressed any recognition of the animals.

*Information:* The children heard a short vignette (176 words) containing ambiguous information regarding one of the animals (counterbalanced across groups e.g. Field 2006a; Field & Lawson, 2003). The information comprised of ambiguous statements regarding the appearance, habitat, behaviour and feeding patterns of the animal. A copy of the vignette can be found in appendix D.

*The State-Trait Anxiety Inventory for Children (STAI-C; Spielberger, 1973):* The Trait Subscale of the Spielberger's State-Trait Anxiety Inventory for Children (STAIC) (Spielberger, 1973) was administered to measure participants' trait anxiety. This self-report measure is designed to assess enduring or chronic anxiety. It contains 20 items each with a four-point Likert-type scale resulting in a maximum total score of 60. The STAIC has been used extensively in research with clinical and non-clinical populations and has well-established psychometric properties. Cronbach's alphas between .78 and .81 and moderate test-retest reliability coefficients between .68 and .71 after an eight week time interval have been reported (Spielberger et al., 1973). In the current sample  $\alpha = .80$ .

*Fear Beliefs Questionnaire (FBQ; Field and Lawson, 2003):* Field and Lawson's (2003) FBQ was used to obtain a measure of the children's fear beliefs regarding the animals. This

computerized instrument is comprised of randomly presented statements relating to children's thoughts, physiological reactions and behaviours towards each animal in 7 hypothetical scenarios (the items are repeated for each animal). Children respond to each statement on a 5-point Likert scale (0= No, not at all; 1 = No, not really; 2 = Don't know/ Neither; 3= Yes, probably; 4 = Yes, Definitely). An average score was calculated from the 7 items for each animal ranging from 0 (no fear beliefs) to 4 (maximum fear beliefs). Each child's mean fear belief at baseline (before the experiment) was subtracted from their mean fear belief after the experimental manipulations to obtain a difference score representing the mean change in fear beliefs. The internal consistencies in the current sample were high and consistent with values across several previous studies (see Field, 2006b): before information;  $\alpha = .82$  (cuscus subscale) and  $\alpha = .87$  (quoll subscale) and after information;  $\alpha = .90$  (cuscus subscale) and  $\alpha = .87$  (quoll subscale).

*Behavioural Approach Task (BAT):* Children were asked to approach two identical pet carriers (a plastic pet carrier designed for a cat) containing a cuddly toy; one labelled 'quoll' and the other 'cuscus'. As such, children believed that they were approaching boxes containing the animals about which they had already answered questions or about which they had heard information. Variations of this task have been used in many previous studies to assess children's behavioural avoidance and physiological responses to animals (e.g. Field & Lawson, 2003; Field et al., 2008; Field & Schorah, 2007; Field & Price-Evans, 2009; Kelly, Barker, Field, Wilson, & Reynolds 2010). These carriers had been modified so that the children could not see inside, and so that a long tube was protruding from the door. This tube contained 11 holes in which the child could place their finger. Children were asked to place their finger into all 11 holes (one hole at a time) along the plastic tube. The holes become progressively closer to the animal box with the first hole being the furthest away from the box and the last whole being the closest. The time taken to

place their finger into the holes and the number of holes completed was used as a measure of their behavioural avoidance.

*Nature Reserve Task (NRT)*: The nature reserve task is designed to measure children's avoidance/feelings towards the animals (Quolls and Cuscuses) without using the touch boxes described above (Field & Storksen-Coulsen, 2007). This task was completed twice, once for the quoll and once for the cuscus. The task uses a rectangular wooden board 45 to 60 cm covered in green material (to give the impression of grass). The edges have fences, bushes and trees made from brown (for wood) and green (for leaves) pipe cleaners. Small yellow balls are stuck to the 'grass' to represent flowers. Children are told that the board represented a nature reserve in Australia, in which one of the animals (e.g. cuscuses) live (at which point the experimenter places a picture of the relevant animal at one end of the nature reserve board). The children are then asked to imagine that they are visiting this nature reserve and they are given a Lego figure (a boy for boys and a girl for girls) that represents them. They are asked to place the Lego figure anywhere in the nature reserve that shows where they would like to be when they visit. The distance (cm) from the centre of the cuscus picture to the Lego figure is measured to indicate the child's relative preference and avoidance of the animal. This procedure is then repeated for the quoll (the cuscus picture is removed and replaced with a picture of a quoll).

*Cognitive rehearsal (CR)*: To measure the extent to which children would naturally cognitively rehearse a future task, a thought sampling task was conducted. The children were told that in a few minutes it will be time for them to approach the animal boxes but for now they should just sit quietly and 'take a break'. After fifteen seconds of 'taking a break'; the experimenter prompted the child to tell her what they had been thinking and anything they said was audio recorded using an Olympus DS30 digital recorder. The children were then instructed to sit

quietly for a further fifteen seconds after which they were once again instructed to tell the experimenter what they had been thinking. This process was repeated twice more, four times in total; therefore, the children were sitting in silence for one minute in total.

*Free-Recall Memory question:* In the free recall memory procedure, the experimenter asked the child to remember as much of the information as possible via an open-ended prompt: ‘Could you now tell me everything you can remember about the information that you heard earlier about the quoll/cuscus’. The child’s response was digitally recorded and coded later (see the *coding* section below).

*Prompted Memory Recall Questions:* Children’s memory of the information was also tested using four prompted open-ended questions because prompt questions have been shown to obtain extra memory information from the children once they had exhausted their free recall memory (Wareham & Salmon, in press; McGuigan & Salmon, 2004). Each question began with ‘What can you remember about what/where/how a cuscus/quoll ...?’ Each question focused on a different attribute of the animal by completing the sentence in a different way: physical appearance (‘looks’), habitat (‘lives’), behaviour (‘behaves’) and feeding (‘eats and drinks’). Therefore, the questions covered all aspects of the information that they had previously heard. See appendix E for a copy of the interpretation bias and memory bias questionnaire.

*Interpretation of the ambiguous information questions:* Each of the four prompted open-ended memory questions (described above) was followed by a set of related questions to assess the child’s interpretation of the original information, (15 in total). Each question required a free response followed by a two alternative forced choice response. For example, the first prompted memory question was ‘What can you remember about how a cuscus/quoll looks?’ This question

was then followed by five related questions one of which was; ‘Cuscuses have long sharp claws that they use to dig and scratch. What do you think they scratch?’ to which the child was asked to respond freely and their response was digitally recorded and later coded (see coding section below). Once the child had finished responding to the question, a two alternative, forced choice question was asked which consisted of a threat interpretation and a neutral interpretation (i.e., ‘which of these do you think is more likely? (A) They scratch humans and other animals or (B) they scratch trees). The full list of questions can be found in appendix E.

#### 2.2.4 *Ethical Issues*

Ethical approval was obtained by the University of Sussex School of Life Sciences ethics committee (see appendix F). The experiment ran on a strict ‘opt- in’ only basis and children were told at the start of the experiment that they could withdraw from the experiment at anytime. At the end of the experiment all children were fully debriefed.

#### 2.2.5 *Debriefing*

For the purpose of this study it was essential to use deception, both in the form of mis-information and also in the behavioural approach task, in which children were falsely told that the boxes contained real animals. A complete and detailed debriefing procedure was used. This procedure consisted of the experimenter reading some factual information about the animals to the class and providing each child with a copy of a fact sheet. The children then completed a word search and a maze using the fact sheet provided to find the correct answers. At the end of the lesson the correct answers were discussed as a class and any questions the children had were answered. A copy of the puzzles and fact sheet can be found in appendix C.

#### 2.2.6 *Procedure*



Both the ambiguous information and FBQ were administered using a custom written computer program in Visual Basic.net written by Andy Field, which was run and completed on an HP pavilion zv5000 laptop computer.

First, children completed the STAI-C with the help of the experimenter. The FBQ was then administered. The preliminary screen provided complete instructions of how to complete the task; when the child was happy that they understood the instructions, they clicked on the 'OK' button, which lead onto the questions. Each question appeared under a named picture of the relevant animal in a randomized order. The children answered each question by clicking on one of five buttons labelled as explained above, after which a button labelled 'Sure?' appeared; this process helped to ensure that children were in no doubt of their response before moving onto the next question. Questions were presented in a random order. Next, children were guided through the nature reserve task twice (once for each animal) which was followed by instructions that they would now hear some information about one of the animals provided by a teacher. The information was administered using the aforementioned custom-written software on the laptop computer. Children listened through headphones to a pre-recorded MP3 file spoken by a female in her mid 20s. A picture of a female adult (an 'average' female face also aged mid-20s supplied by Professor David Perrett's laboratory at St. Andrews University, UK), was displayed on the left side of the computer screen and an image of the relevant animal was displayed on the right side of the screen. This procedure ensured that the transfer of information was identical across the children.

The children were then told that in a few minutes time they will be asked to approach the animal boxes and put their fingers in the holes but for now they should just sit quietly and 'take a break'. At fifteen-second intervals, the experimenter prompted the children to tell her what they had

been thinking and their responses were audio recorded for later coding. This process was repeated four times in total; therefore, the children were sitting in silence ‘taking a break’ for one minute in total. The free-recall measure of memory was then administered: children were then asked to recall as much of the information that they had previously heard as possible and again their response was audio recorded. Next, the children completed the FBQ for the second time and were then told that they would now approach the animals. The touch box task began with each child stood on a marked position on the floor, they were then asked to place their finger into all 11 holes (one hole at a time) along the plastic tube. The holes become progressively closer to the animal box with the first hole being the furthest away from the box and the last whole being the closest. The children then completed the nature reserve task for the second time twice (once for each animal). The children were then given the prompted-recall memory task followed by the ‘interpretation of ambiguous information’ measure (read aloud by the experimenter) regarding the animal about which they had heard information and their responses were audio recorded. Finally the children were debriefed.

### 2.2.7 *Coding*

All data were coded by the experimenter and a sample of 10 data sets (18%) were second coded by an independent non-psychologist.

*Cognitive rehearsal:* As described above children were asked by the experimenter what they had been thinking about four times at 15 second intervals whilst ‘taking a break’. This produced four sets of thoughts, which could have been about anything at all. Each thought the child had about the animal and/or approach task was coded for severity using one of the following five categories; 5 = very positive thought, 4 = medium positive thought, 3 = low positive thought, 2 = low negative thought, 1 = medium negative thought, 0 = very negative thought. A mean severity

score was then calculated for each child by subtracting their severity of non-animal thoughts from their severity of animal thoughts. The inter-rater reliability for the severity of thoughts was significant, Cohen's  $\kappa = .58, p < .01$ .

*Prompted Memory questions and Free Recall of verbal information:* Answers to the open-ended memory questions were coded as follows: each statement the child recalled about the animal was coded as belonging to one of the following categories: an accurate recall of the original information, from the original information but remembered more negatively, from the original information but remembered more positively, a negative statement not from the original information (a false negative memory), a positive statement not from the original information (a false positive memory), or a neutral statement not from the original information (a false neutral memory). These scores were then totalled across questions so that each child had a total score for: the number of accurate memories, the number of more negative memories, the number of more positive memories, the number of false negative memories, the number of false positive memories and the number of false neutral memories for prompted memory and free recall. Inter-rater reliability for the prompted recall memory questions (1, 2, 3 and 4) was significant, Cohen's  $\kappa = .83, p < .001$ , as was the inter-rater reliability for the free recall, Cohen's  $\kappa = .83, p < .001$ . Inter-rater reliability was not measured for free recall 'false memories' because in the sample of 10 children whose data were second coded, very few false memories were reported.

*Interpretation of verbal information:* Responses to the two alternative forced choice questions were scored as being either a threat or non-threat interpretation. Free response interpretation questions were also coded as being either a threat interpretation (and given a score of 1) or as a non-threatening interpretation (and given a score of 0). These scores were then added together to give each child a total score for forced choice interpretation and free recall interpretation, with a

higher score indicating a more negative interpretation bias. The minimum interpretation bias score a child could get was zero indicating that all their responses were non-threat interpretations of the information, the maximum score a child could get was 15, which would indicate that all their responses were threat interpretations of the information. Inter-rater reliability for the free response interpretation questions was significant, Cohen's  $\kappa = .94$ ,  $p < .001$ .

## 2.3 Results

### 2.3.1 Data Scoring and Initial Analysis

*The touch box data:* The touch box task produced a ceiling effect in that the majority of children put their finger into all of the holes along the touch box tube, regardless of whether they had heard some ambiguous information about the animal or not. Looking at the two histograms below (Figures 2.1 and 2.2) it can be seen that there was little variance in the scores and therefore, no further analysis was conducted on these data.

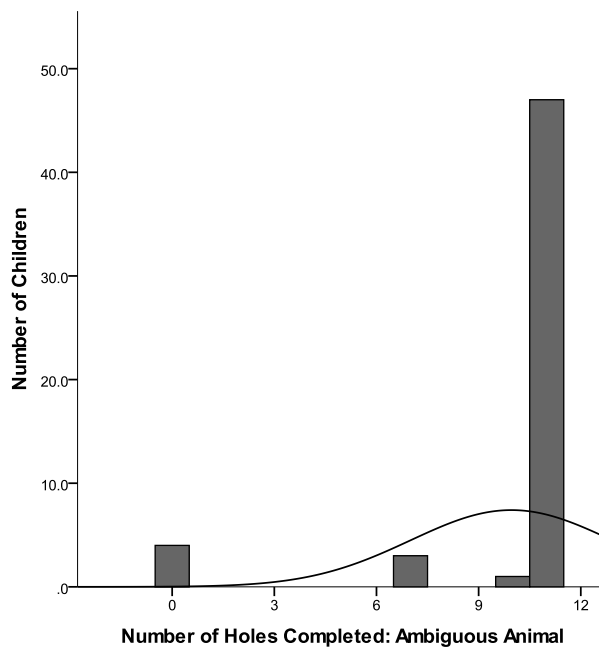


Figure 2.1: Histogram of the number of holes of the information animal box into which children put their finger.

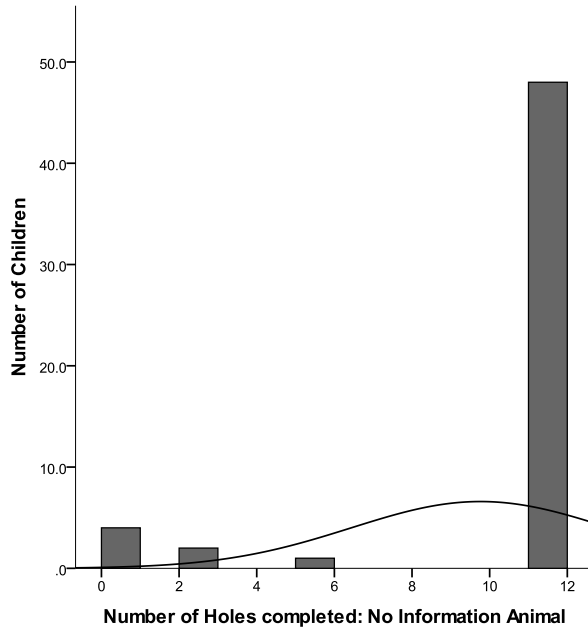


Figure 2.2: Histogram of the number of holes of the no information animal box into which the children put their finger.

*Interpretation of ambiguous information data:* A bias corrected bootstrap of Pearson's correlation coefficient revealed that the scores for the open response and forced choice interpretation questions were highly correlated;  $r = .75$ ,  $p < .001$  (two-tailed). Therefore, it was decided to combine these two variables to create a new variable called 'interpretation bias' and this was done by calculating the average of each child's total score for the open response and forced choice questions.

*Memory Variables: Prompted and Free recall:* There are 10 different memory variables (free recall and prompted recall for each of accurate, more negative, more positive, false negative, false positive). To see how these variables relate to each other, a principal components analysis was run on all the data from all three experiments as described in Chapter 5. The principal components analysis was conducted on all the data from Experiments 1, 2 and 3 combined rather than on the data from each individual experiment to provide a larger data sample ( $N = 187$ ) and

therefore, a more reliable result. For example, a sample size of 100 has been classed as poor and a sample size of 300 has been classed as good (Comrey & Lee, 1992, cited in Field, 2009). There are fewer than 100 participants per experiment (approx 55 in each) therefore each has a 'poor' sample size; by combining the data we get a better approximation of a 'good' sample size ( $N = 187$ ). The result of the analysis, described in detail in Chapter 5, was five components that related very clearly to accurate memory, more positive, more negative, false positive and false negative. Each component had two variables that loaded onto it: the free and prompted versions. Therefore, five new variables were created for use in the following analysis that were the average of free and prompted recall. These were: accurate memory, more negative memory, more positive memory, false negative memory and false positive memory. See Chapter 5 for a full description of the principal components analysis.

*Table 2.1: Descriptive statistics of all the main variables*

	<i>N</i>	<b>Minimum</b>	<b>Maximum</b>	<i>M</i>	<i>SD</i>
STAI-C	55	25	49	37.40	6.30
FBQ	55	-1.10	4.10	3.70	.90
NRT	55	-43.0	62.00	4.20	16.90
IB	55	.00	11.50	4.20	2.90
False positive Memory	55	.00	2.00	.20	.40
False Negative memory	55	.00	1.50	.20	.30
More negative memory	55	.00	2.00	.50	.50
Accurate memory	55	.00	8.00	2.70	1.60
More Positive memory	55	.00	2.50	.80	6.10
CR	51	.00	4.30	2.20	1.10

(CR = Cognitive rehearsal, IB = Interpretation bias)

Table 2.2: Bias corrected bootstrap Pearson correlation coefficients and their Confidence Intervals (based on 1000 samples) for all main variables

Variables		Pearson Correlation	CI (Lower, Upper)
STAI-C	FBQ	.03	-.18, .26
	NRT	-.03	-.23, .17
	IB	-.03	-.31, .26
	CR	.00	-.29, .36
	False Negative Memory	-.10	-.32, .17
	False Positive Memory	.04	-.31, .34
	More Negative Memory	-.22	-.46, .08
	Accurate Memory	-.09	-.35, .18
	More Positive Memory	-.08	-.38, .23
FBQ	NRT	.36**	-.12, .63
	IB	.33*	-.12, .61
	CR	-.14	-.40, .13
	False Negative Memory	.18	-.18, .54
	False Positive Memory	-.16	-.31, .03
	More Negative Memory	-.15	-.36, .18
	Accurate Memory	.10	-.14, .36
	More Positive Memory	.19	-.14, .45
NRT	IB	.13	-.23, .43
	CR	-.06	-.39, .31
	False Negative Memory	-.08	-.43, .26
	False Positive Memory	-.28*	-.57, .15
	More Negative Memory	-.03	-.27, .23
	Accurate Memory	-.07	-.31, .15
	More Positive Memory	-.01	-.31, .26
IB	CR	-.28*	-.50, -.05
	False Negative	.02	-.26, .33
	False Positive	-.13	-.36, .13
	More Negative	.00	-.35, .32
	Accurate	-.22	-.41, .01
	More Positive	-.32*	-.57, -.02
CR	False Negative Memory	.02	-.25, .27
	False Positive Memory	.12	-.30, .59
	More Negative Memory	.00	-.29, .28
	Accurate Memory	.15	-.11, .41
	More Positive Memory	.29*	.04, .51
False Negative Memory	False Positive Memory	.12	-.18, .34
	More Negative Memory	-.03	-.24, .25
	Accurate Memory	-.05	-.37, .35
	More Positive Memory	.10	-.25, .48
False Positive Memory	More Negative Memory	.02	-.25, .35
	Accurate Memory	-.09	-.29, .19
	More Positive Memory	-.12	-.37, .18
More Negative Memory	Accurate Memory	.41**	.16, .61
	More Positive Memory	.11	-.18, .41
Accurate Memory	More Positive Memory	.40**	.19, .60

\*\* Correlation is significant at the 0.01 level (2-tailed). \* Correlation is significant at the 0.05 level (2-tailed).



*Analysis:* All hypotheses for Experiment 1 were tested by performing simple regressions. The  $b$  coefficients and their standard errors were estimated using bias corrected bootstrapped samples based on 1000 samples in IBM SPSS 18.

### 2.3.2 *Hypothesis 1: Trait anxiety should predict fear*

Hypothesis 1 stated that the more trait anxious the child, the more fearful they would become of the animals following the information and cognitive rehearsal task; however, Table 2.3 shows that this was not found to be the case: trait anxiety did not significantly predict change in fear beliefs (FBQ) or avoidance (NRT).

### 2.3.3 *Hypothesis 2: Interpretation bias should mediate the relationship between trait anxiety and fear*

Contrary to expectations, Table 2.3 also shows that trait anxiety was not a significant predictor of interpretation bias; children who were more trait anxious did not interpret the information in a more threatening way than the children who were not trait anxious. Similarly and again contrary to expectations, Interpretation bias did not significantly predict fear beliefs (FBQ) or avoidance (NRT) so, the way in which children interpret ambiguous information (either as threatening or not) did not significantly impact on their fear beliefs and avoidance (Table 2.3), thus interpretation bias did not mediate the relationship between trait anxiety and fear.

### 2.3.4 *Hypothesis 3: Cognitive rehearsal should mediate the relationship between trait anxiety and fear*

This hypothesis was also found to be incorrect. Table 2.3 also shows that trait anxiety was not a significant predictor of cognitive rehearsal, children who were more trait anxious did not engage in more severely negative thoughts than the children who were less trait anxious. Similarly and again contrary to expectations, cognitive rehearsal did not significantly predict fear beliefs

(FBQ) or avoidance (NRT) so, whether the children had severely negative thoughts or positive thoughts did not significantly impact on their fear beliefs and avoidance (Table 2.3), thus cognitive rehearsal cannot be tested as a mediator of the relationship between trait anxiety and fear.

*Table 2.3: Bias corrected bootstrap estimated regression coefficients and their standard errors (based on 1000 samples) of eight independent regressions that were run with a different outcome variable each time.*

Predictor	Outcome	<i>B</i>	<i>SE</i>	CI (lower)	CI (upper)	<i>P</i>	<i>R</i> <sup>2</sup>
<b>STAI-C</b>	FBQ	.01	.02	-.02	.04	.47	.00
	NRT	-.02	.33	-.67	.63	.94	.00
	IB	.01	.06	-.11	.13	.88	.00
	CR	-.00	.03	-.06	.06	.99	.00
<b>IB</b>	FBQ	.10	.06	-.01	.21	.29	.10
	NRT	.81	1.06	-1.21	2.78	.59	.02
<b>CR</b>	FBQ	.12	.13	-.11	.36	.37	.02
	NRT	.86	2.84	-4.62	6.22	.74	.00

Trait anxiety (STAI-C), Interpretation bias (IB) and Cognitive rehearsal (CR).

### 2.3.5 *Hypothesis 4: Interpretation bias should predict biased memory and this relationship should be moderated by trait anxiety*

Hypothesis 4 stated that interpretation bias should predict biased memory: children who disambiguate the information in a more threatening way should then encode this information as being more threatening in memory and as such should remember the information as being more negative than it was. Nevertheless, as Table 2.4 shows, this was not found to be the case for any of the memory variables. Because a significant relationship was not found between interpretation bias and memory bias, trait anxiety cannot be tested as a moderator. However, one finding that came close to being significant ( $p = .06$ ) was that the greater the child's interpretation bias for the information, the less accurate their memory was for the information (Table 2.4), so an interpretation bias decreased memory accuracy of the information and vice versa.

Table 2.4: Shows the bias corrected bootstrap estimates of the regression coefficients and their standard errors (based on 1000 samples) of five independent regressions that were run with a different outcome variable each time.

Predictor	Outcome	<i>B</i>	<i>SE</i>	CI (lower)	CI (upper)	<i>p</i>	<i>R</i> <sup>2</sup>
<b>IB</b>	<b>Accurate</b>	-.11	.06	-.26	.02	.06	.043
	<b>More Negative</b>	-.01	.03	-.06	.05	.87	.00
	<b>More Positive</b>	-.05	-.03	-.12	.00	.11	.06
	<b>False Negative</b>	.00	.02	-.03	.03	.91	.00
	<b>False Positive</b>	-.02	.02	-.05	.01	.11	.02

### 2.3.6 Hypothesis 5: Memory should mediate the relationship between interpretation bias and fear

For mediation to have occurred the following needs to be true (Baron and Kenny, 1986): (1) Interpretation bias should significantly predict fear; (2) Interpretation bias should significantly predict memory; (3) the relationship between interpretational bias and fear should be significantly reduced when memory is entered as a simultaneous predictor. Therefore, because there was no significant relationship between IB and FBQ or between IB and NRT (Table 2.3) it does not make sense to test for mediation. False-positive memory did, however, have a significant negative relationship with fear beliefs (Table 2.5), this suggests that children who remembered more false-positive information become less fearful of the animals after the information relative to children who remembered less false-positive information. This finding indicates that the way in which information is encoded into memory impacts on fear beliefs.

Table 2.5: Shows the bias corrected bootstrap estimates of the regression parameters and their standard errors (based on 1000 samples) of ten independent regressions that were run with a different outcome variable each time.

Memory Predictor	Outcome	<i>b</i>	<i>SE</i>	CI (lower)	CI (upper)	<i>P</i>	<i>R</i> <sup>2</sup>
Accurate	NRT	-.75	1.37	-3.42	1.23	.54	.01
	FBQ	.07	.06	-.07	2.0	.16	.02
More Negative	NRT	-2.03	4.16	-11.02	6.80	.59	.00
	FBQ	-.27	.23	-.79	.26	.24	.02
More Positive	NRT	-.17	4.13	-7.86	8.27	.97	.00
	FBQ	.25	.22	-.24	.76	.31	.03
False Negative	NRT	-5.24	12.28	-28.08	13.38	.78	.01
	FBQ	.44	.64	-.57	1.84	.70	.02
False Positive	NRT	-12.42	7.27	-22.44	9.79	.15	.08
	FBQ	-.35*	.22	-.80	.12	.02	.02

\* $p < .05$

## 2.4 Discussion

Contrary to what was expected, the present study indicates that high levels of trait anxiety did not predict increased levels of fear and avoidance due to verbal information. This finding is inconsistent with Field (2006b; Field & Price-Evans, 2009) who found that trait anxiety moderates the effect of threat information on fear. Specifically, children high on trait anxiety showed greater avoidance and attentional bias towards previously novel animals after experiencing verbal information. However, Field (2006) used threat information whereas ambiguous information was used in the current study, which probably explains this inconsistency. Nevertheless, we predicted that anxious children should interpret the ambiguous information in a more threatening way and this did not appear to be the case. This finding is not only inconsistent with what was predicted but also with a growing body of research which have demonstrated that high trait anxious children *do* show a tendency for interpreting ambiguous stimuli as threatening (Bogels & Zigterman, 2000; Hadwin et al., 1997; Muris, Merckelbach et al., 2000; Muris & van Doorn, 2003; Taghavi et al., 2000; Lester, Seal, Nightingale & Field,

2010). Additionally, this finding is inconsistent with the adult literature; research has shown that anxious individuals tend to interpret ambiguous stimuli or events as negative or threatening (e.g., Amir, Beard & Bower, 2005; Eysenck, Mogg, May, Richards, & Mathews, 1991). For example, when presented with ambiguous sentences, participants with a clinically diagnosed anxiety disorder were more likely to offer threatening (rather than non-threatening) interpretations compared to recovered clinically anxious and never anxious participants (Eysenck et al., 1991). Another unexpected finding was that the way in which children interpreted the ambiguous information (as either threatening or non-threatening) regardless of whether they were anxious or not, did not significantly predict memory encoding nor did it significantly predict fear and avoidance. However, there was a trend in the direction of greater levels of interpretation bias predicting less accurate memory, therefore suggesting that children who showed a greater interpretation bias for the information remembered the information less accurately, however this finding did not quite reach significance.

Interestingly, children who remembered less false positive information (positive information remembered that was not in fact told) became more fearful of the animals due to information whereas children who remembered more false positive memories showed a decrease in fear beliefs due to information. This finding is in line with Williams (1997) who reported that depressed individuals show a greater latency to retrieve positive life events from memory than non-depressed individuals; however, they are not much quicker than non-depressed controls at retrieving negative events. Although the current study is looking at anxiety and not depression, it is well documented that anxiety and depression are strongly related conditions in both adult and youth populations (Mineka, Watson, & Clark, 1998; Seligman & Ollendick, 1998). Additionally,

it has been argued that anxiety and depression share a variety of cognitive aspects (e.g., Kendall & Watson, 1989).

The present findings also indicate that high levels of child trait anxiety do not significantly predict a negative thinking style; additionally the severity of the children's cognitive rehearsal had no significant impact on their levels of fear or avoidance. These findings are surprising because anxious youth frequently present to the clinical setting expressing a repetitive thinking style regarding anticipated negative outcomes or feared events (Comer, Kendall, Franklin, Hudson, & Pimental, 2004) and support has been found for the importance of rumination in the strengthening and maintenance of anxious states (Rector, Antony, Laposa, Kocovski & Swinson (2008).

One potential problem with the current study was that during the naturalistic cognitive rehearsal task in which children were instructed to 'take a break', the majority of children thought about the animal (mean number of animal thoughts per child = 2.85), very few children had thoughts that were not about the animal (mean number of non animal thoughts per child = 0.71); therefore, a true comparison between the effects of thinking about the animal vs. not thinking about the animal could not be made. The next step would be to include a control group who would be prevented from thinking about the animal and information by engaging them in a distracter task. This would provide a baseline of not thinking against which to compare the thinking scores. As such, it would be necessary to manipulate cognitive rehearsal, in other words instead of asking children to relax and take a break; explicitly asking them to repeatedly think about the animal and information and keep reminding them to do so. This would help to ensure that they were thinking in an iterative style.

### **3 Experiment 2: The Effect of Cognitive Rehearsal vs. Distraction**

#### **3.1 Introduction**

Experiment 1 was a naturalistic study which looked at what children naturally think about after hearing some ambiguous information about a novel animal and whether what they think varies as a function of trait anxiety. The results revealed that none of the original hypotheses were supported: high trait anxious children did not become more fearful of the animals due to information, nor were they more likely to interpret the information as threatening or remember it to be more threatening than it was originally. Additionally, fear levels were not significantly affected by the presence of an interpretation or memory bias. It was also predicted that trait anxious children would cognitively rehearse the information resulting in them becoming more fearful of the animal. However, trait anxiety did not significantly predict cognitive rehearsal; in other words, it was found that trait anxious children are not more likely to cognitively rehearse ambiguous information than non trait anxious children. Additionally, the extent to which children cognitively rehearsed did not significantly predict how fearful they became.

Nevertheless, it was found that the majority of children had thoughts about the animals, and there were very few children who thought about something other than the animals; therefore, there was no group of ‘non-animal thinkers’ to compare against the group of children who thought about the animal. The aim of Experiment 2, therefore, was to explore the effect of manipulating cognitive rehearsal about ambiguous information. The current experiment looked at the effect of explicitly instructing children to think iteratively about the animals compared to a control group who completed a verbal distracter task, aimed at preventing them from thinking about the animals. This experimental manipulation would provide a group of children who did not think

about the animals making it possible to investigate the causal effect of thinking vs. not thinking about the animals on fear levels towards the animals.

Although there is currently limited research into cognitive rehearsal in the child anxiety literature, the research that is available has shown that this style of negative repetitive thought is present in anxious children (Comer, et al. 2004), reflects detrimental thought processes and is believed to play a part in the etiology of both depression and anxiety disorders (e.g., Barlow, Allen, & Choate, 2004). Additionally, a negative repetitive style of thinking is believed to be associated with poor problem solving skills, impaired motivation, and inhibition of instrumental behaviour (see Lyubomirsky & Tkach, 2004 for a review). Therefore, it was predicted that by instructing children to cognitively rehearse ambiguous information about novel animals, fear beliefs and avoidance would increase in all children but this relationship would be stronger for those who are more trait anxious than for those who are less trait anxious.

The hypotheses for Experiment 2 remain the same as in Experiment 1, with the exception of the hypotheses relating to cognitive rehearsal (*see* hypothesis 3): (1) Replicating Field (2006b), children who are more trait anxious, relative to children who are less trait anxious, would become more fearful of a novel animal after hearing some ambiguous information about it. (2) Because children who are more trait anxious have been found to disambiguate ambiguous information as more threatening (Field, 2006b), the relationship between trait anxiety and fear should be mediated by interpretation bias in other words, children who are more trait anxious would interpret the information as being more threatening and therefore become more fearful of the animals. (3) Cognitive rehearsal (whether the child was asked to think about the ambiguous information vs. engage in a distractor task) would result in an increase in fear beliefs and avoidance in all children but this relationship would be stronger for those who are more trait



anxious than for those who are less trait anxious. In other words, induced cognitive rehearsal would moderate the relationship between trait anxiety and fear. (4) Children who disambiguate the verbal information in a threatening way (interpretation bias) would subsequently encode the information more negatively into memory and therefore show a memory bias for the information and this relationship would be moderated by trait anxiety. (In other words, the relationship between interpretation and memory would be stronger for highly trait anxious children than for less trait anxious children.) (5) Finally it is predicted that memory will mediate the relationship between interpretation bias and fear: children who interpret the information as being more threatening would also encode the information as being more threatening into memory which would lead to them becoming more fearful of the animals.

### **3.2 Method**

Most of the materials and procedures in this experiment were identical to Experiment 1.

#### *3.2.1 Design*

As in Experiment 1, two unfamiliar Australian marsupials were used: a quoll and a cuscus. Information was manipulated so that children heard some ambiguous information about one of the animals and no information about the other animal (counterbalanced across groups). Cognitive rehearsal was manipulated by asking half of the children to think about the information they were given about one of the animals and the other half were instructed to complete a distracter task to prevent them from thinking about the animals (counterbalanced across groups). The thoughts of the group who were instructed to think about the information were subsequently scored for severity, which could range from 0 (severe negative thought) to 5 (severe positive thought). The dependent variables were identical to those in Experiment 1: fear beliefs (Fear Beliefs Questionnaire, FBQ) and avoidance (Nature Reserve Task, NRT) both

measured before the information was given and after the information and cognitive rehearsal phases of the experiment; behavioural avoidance (measured using a Behavioural Approach Task), memory of the information (measured using a free recall task and prompted memory questions), interpretation of the ambiguous information (measured using both forced choice and free response questions). Trait anxiety was measured as a predictor using the State Trait Anxiety Inventory for Children (STAI-C, Spielberger, 1973).

### 3.2.2 *Participants*

Fifty-four children (17 boys, 37 girls) between the ages of 9 and 11 years ( $M = 125.44$  months,  $SD = 5.80$ ) took part. This age range was chosen because normative fears are focused on animals during this period (Field and Davey, 2001). Twenty-seven children were instructed to think about the information they just heard and the impending task of approaching the animals (20 girls and 7 boys) and 27 children completed the distraction task (17 girls and 10 boys). The children were enrolled from a primary school in West Sussex, U.K. The school was a smaller than average primary school, situated in a seaside town near Brighton. Very few pupils were eligible for free school meals. Only a few pupils speak a language other than English at home. Parents of children in years four (8-9 years), five (9-10 years) and six (10-11 years) were sent letters (see appendix A) describing the procedures used in the experiment (but not the main purpose) along with a consent form (see appendix B) to return to the school if they would like their child to participate (the experiment ran strictly on an opt-in basis only). A total of 160 children were invited to participate, giving a response rate of 34%. At the start of the testing session, children were reminded that they could withdraw at anytime.

### 3.2.3 *Cognitive Rehearsal*

To investigate the effect of manipulating cognitive rehearsal about ambiguous information and a future task, half of the child sample completed a cognitive rehearsal task in which they were instructed to think specifically about the information and the impending behavioural approach task. They were told ‘In a few minutes you are going to approach the animal box and put your hand in but for now I would like you to think to yourself about the information you have just heard and the task of putting your hand in the animal box’. After 15 seconds the children were prompted to tell the experimenter what they had been thinking and their response was audio recorded using a digital voice recorder. The children were then instructed to carry on thinking about the information and future task and again after 15 seconds the children were prompted to tell the examiner what they had been thinking and their response was audio recorded as before. This process was repeated a further two more times (four times in total) and all child responses were audio recorded by the experimenter for later coding. The other half of the child sample completed a distracter task (see below) to prevent them from cognitively rehearsing the information as much as possible.

*Distracter task to prevent cognitive rehearsal:* To investigate the effects of manipulating cognitive rehearsal, it was necessary for half of the child sample to be prevented from cognitively rehearsing about the animals and approach task. To achieve this goal, half of the children completed a distracter task in which they were asked to say a random letter of the alphabet out loud to the experimenter, one per second for one minute. Rapee (1993) found that participants were least able to worry whilst completing verbal tasks such as this one relative to other tasks such as spatial tasks.

### 3.2.4 *Ethical Issues*

Ethical approval was obtained by the University of Sussex School of Life Sciences ethics committee (see appendix F). The experiment ran on a strict ‘opt- in’ only basis and children were told at the start of the experiment that they could withdraw from the experiment at anytime. At the end of the experiment all children were fully debriefed.

### 3.2.5 *Procedure*

The procedure for Experiment 2 was identical to that for Experiment 1 except there was a variation on the cognitive rehearsal task. Specifically, after hearing the ambiguous information, half of the children were instructed to think quietly to themselves about the information and the impending behavioural approach task, after 15 seconds of thinking, the experimenter prompted them to tell her what they had been thinking and their responses were audio recorded using a digital voice recorder. This process was repeated four times in total, therefore the children were ‘thinking’ for one minute in total. The other half of the children completed a distracter task (described below) to prevent them from thinking about the information as much as possible.

### 3.2.6 *Coding*

As in Experiment 1, all data sets were coded by the experimenter and a sample of 10 were second coded by an independent non-psychologist.

*Inter-rater reliability:* Inter rater reliability for the interpretation of ambiguous information was significant, Cohen’s  $\kappa = .98, p < .001$ , as was the inter-rater reliability for the prompted recall memory questions, Cohen’s  $\kappa = .77, p < .001$ , and also for the free recall memory task, Cohen’s  $\kappa = .56, p < .001$ . As in Experiment 1, inter-rater reliability was not measured for ‘false memories’ in the free recall task because in the sample of 10 children whose data were second coded, there were hardly any false memories reported.

*Internal consistency data for Fear beliefs questionnaire (FBQ, Field and Lawson, 2003):* The internal consistencies in the current sample were high and consistent with values across several previous studies (see Field, 2006b) and with Experiment 1: before information;  $\alpha = .76$  (cuscus subscale) and  $\alpha = .81$  (quoll subscale) and after information;  $\alpha = .91$  (cuscus subscale) and  $\alpha = .87$  (quoll subscale).

*Internal Consistency data for The State-Trait Anxiety Inventory for Children (STAI-C; Spielberger, 1983):* The STAI-C was found to have high reliability in the current sample;  $\alpha = .85$

### **3.3 Results**

#### *3.3.1 Initial Analyses*

*Cognitive Rehearsal:* A Wilcoxon's rank-sum test showed that on average children had significantly more threat thoughts than non threat thoughts about the animal for which they heard some ambiguous information,  $z = -2.8, p < .01$ .

*Touch box data:* As in Experiment 1, the touch box task produced a ceiling effect in that the majority of children put their finger into all the eleven holes. Looking at the two histograms below (Figures 3.1 and 3.2) it can be seen that there is little variance in the scores and therefore, no further analysis was conducted on these data.

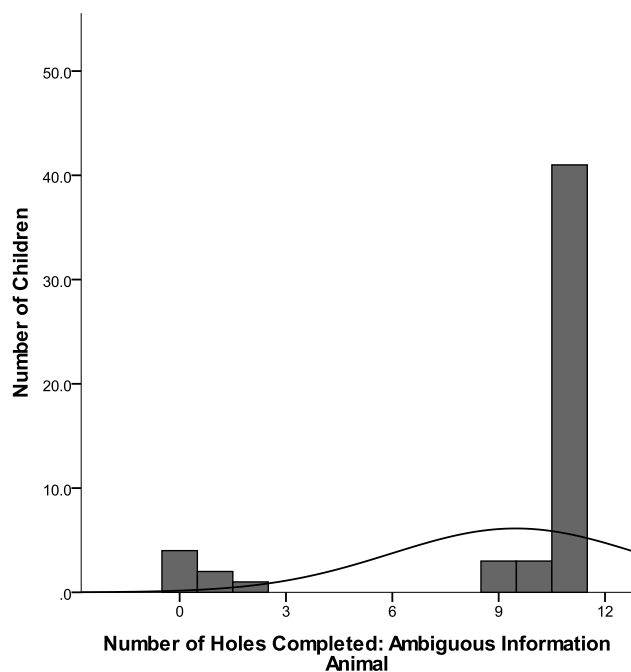


Figure 3.1: Histogram of the number of holes in the information animal box into which the children would put their finger.

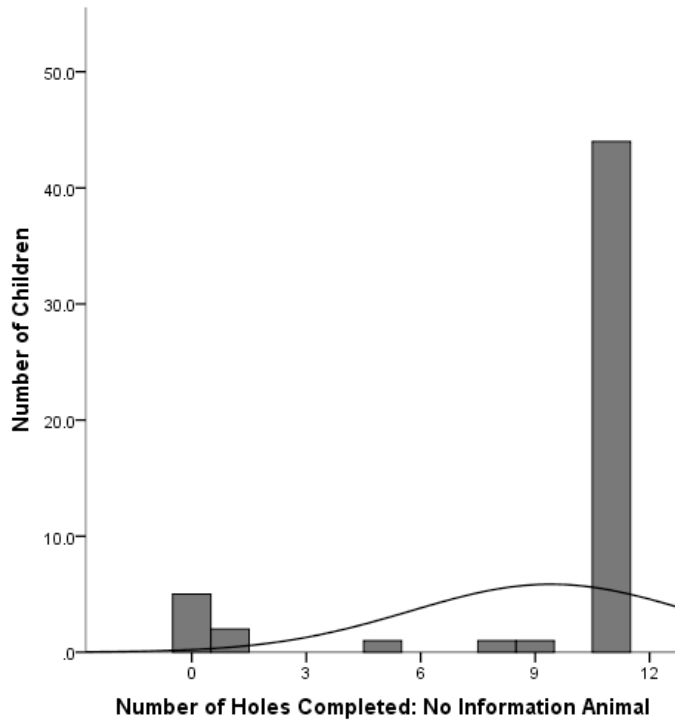


Figure 3.2: Histogram of the number of holes of the no information animal box into which children would put their finger.

*Interpretation of ambiguous information data:* It was found that the scores for the open response and forced choice interpretation questions were highly correlated Pearson's bootstrapped  $r = .67$ ,  $p = .00$  (two-tailed) and so it was decided to combine these variables calculating the average of the open response and forced choice scores for each child to create a new variable called *interpretation bias*.

*Analysis:* Analyses were conducted by performing simple regressions unless stated otherwise. The estimates and their standard errors of the regression coefficients were bias corrected bootstrapped based on 1000 samples.

*Table 3.1: Descriptive statistics of all the main variables*

	<i>N</i>	<b>Minimum</b>	<b>Maximum</b>	<i>M</i>	<i>SD</i>
STAI-C	54	23.00	54	35.91	7.20
FBQ	54	-1.63	2.50	.32	.84
NRT	54	-25.50	51.00	1.46	12.44
IB	54	1.50	10.50	4.79	2.42
Accurate Memory	54	.00	7.50	3.04	1.51
More Negative Memory	54	.00	2.50	.66	.69
False Negative Memory	54	.00	3.00	.58	.78
More Positive Memory	54	.00	3.00	.75	.67
False Positive Memory	54	.00	2.00	.20	.45
CR Severity	27	.00	3.25	1.78	1.00



Table 3.2: Bias corrected bootstrap Pearson correlation coefficients and their Confidence Intervals (based on 1000 samples) for all main variables

Variables		Pearson Correlation	CI (Lower, Upper)
CR vs. Distractor Condition	FBQ	.05	-.23, .31
	NRT	-.18	-.41, .09
	IB	-.04	-.32, .27
	False Negative Memory	-.13	-.39, .21
	False Positive Memory	-.04	-.28, .23
	More Negative Memory	.09	-.19, .34
	Accurate Memory	-.12	-.34, .12
	More Positive Memory	-.01	-.29, .28
STAI-C	FBQ	.45*	.02, .70
	NRT	.28	-.11, .62
	IB	.16	-.23, .50
	CR Severity	-.37	-.67, -.09
	False Negative Memory	.90	-.30, .43
	False Positive Memory	.14	-.32, .52
	More Negative Memory	.38	.02, .69
	Accurate Memory	.01	-.45, .44
FBQ	More Positive Memory	.01	-.33, .45
	NRT	.46*	.03, .77
	IB	.32	-.04, .63
	CR Severity	-.48*	-.72, -.20
	False Negative Memory	.39	-.10, .75
	False Positive Memory	.17	-.20, .64
	More Negative Memory	.48*	.13, .78
	Accurate Memory	-.06	-.51, .36
NRT	More Positive Memory	.05	-.27, .38
	IB	.30	-.01, .55
	CR Severity	-.50*	-.70, -.26
	False Negative Memory	-.01	-.33, .32
	False Positive Memory	.14	-.14, .47
	More Negative Memory	.37	-.11, .71
	Accurate Memory	.17	-.22, .49
	More Positive Memory	-.02	-.45, .43
IB	CR Severity	-.44*	-.72, -.20
	False Negative	.35	-.02, .66
	False Positive	.42*	.15, .68
	More Negative	.36	-.02, .68
	Accurate	.11	-.34, .52
	More Positive	-.03	-.44, .40
CR Severity	False Negative Memory	-.24	-.62, .18
	False Positive Memory	-.40*	-.74, .10
	More Negative Memory	-.35	-.71, .07
	Accurate Memory	.14	-.17, .48
	More Positive Memory	.12	-.25, .43
False Negative Memory	False Positive Memory	.01	-.29, .43
	More Negative Memory	-.01	-.37, .48
	Accurate Memory	-.03	-.34, .25
	More Positive Memory	.04	-.29, .40
False Positive Memory	More Negative Memory	.29	-.21, .73
	Accurate Memory	-.22	-.54, .06
	More Positive Memory	-.26	-.54, -.04
More Negative Memory	Accurate Memory	.06	-.39, .47
	More Positive Memory	-.34	-.65, .03
Accurate Memory	More Positive Memory	.09	-.27, .48

\*\* Correlation is significant at the 0.01 level (2-tailed). \* Correlation is significant at the 0.05 level (2-tailed). CR vs. Distractor (whether the children were in the cognitive rehearsal or distractor condition) CR Severity (the severity of thoughts of children in the cognitive rehearsal condition).

### 3.3.2 *Hypothesis 1: Trait anxiety should predict fear*

In Experiment 1, contrary to expectations, trait anxiety did not significantly predict change in fear beliefs (FBQ) or avoidance (NRT). However, Table 3.3 shows that in the current experiment, although trait anxiety once again does not significantly predict avoidance, it does predict fear beliefs: children who were more trait anxious became more fearful of the animals subsequent to hearing the information relative to less trait anxious children.

### 3.3.3 *Hypothesis 2: Interpretation bias should mediate the relationship between trait anxiety and fear*

It was predicted that the relationship between trait anxiety and fear would be mediated by interpretation bias; specifically, a child who is more trait anxious is more likely to interpret information in a negatively biased way and this interpretation bias creates an increase in fear (in other words trait anxiety should, as well as having a direct effect on fear, have an indirect effect via interpretational biases). For this mediation model to be true (1) trait anxiety should predict fear (which it does), (2) interpretation bias should predict fear beliefs, which is not the case (Table 3.3), and (3) trait anxiety should significantly predict interpretation bias, which is also not the case (Table 3.3). The fact that interpretation bias does not significantly predict fear beliefs and trait anxiety does not significantly predict interpretation biases means that interpretation biases do not mediate the relationship between trait anxiety and the change in fear beliefs towards the animals.

### 3.3.4 *Hypothesis 3: Cognitive rehearsal (whether or not children were instructed to think about the information and future touch box task or not) should moderate the relationship between trait anxiety and fear.*

It was hypothesized that the relationship between trait anxiety and fear beliefs would be *moderated* by cognitive rehearsal (whether children were instructed to think about the information and future touch box task or not). Moderation is different to mediation in that a mediator variable explains the relationship between two other variables whereas a moderator is a variable that influences the strength of the relationship between two other variables (MacKinnon, 2008). Thus, the current hypothesis is that the relationship between trait anxiety and fear beliefs will be stronger for trait anxious children who were instructed to think about the information and future approach task relative to those who were in the distracter group. In other words, fear beliefs will be exacerbated by a combination of trait anxiety and cognitive rehearsal. This hypothesis was tested by predicting fear beliefs from trait anxiety, cognitive rehearsal and the interaction between trait anxiety and cognitive rehearsal (Table 3.4). The independent regressions included CR, STAI-C and also their interaction term (to test for moderation). Looking at Table 3.4, the cognitive rehearsal task did not significantly predict fear and the interaction between cognitive rehearsal and trait anxiety was not significant, therefore, cognitive rehearsal did not moderate the relationship between trait anxiety and fear beliefs.

*Table 3.3: Bias corrected bootstrap estimated regression coefficients and their standard errors (based on 1000 samples) of five independent regressions that were run with a different outcome variable each time.*

Predictor	Outcome	<i>B</i>	<i>SE</i>	CI (lower)	CI (upper)	<i>p</i>	<i>R</i> <sup>2</sup>
<b>STAI-C</b>	FBQ	.04*	.02	.01	.07	.03	.12
	NRT	−9.72	6.68	−24.26	.64	.07	.03
	IB	.02	.04	−.06	.10	.58	.00
<b>IB</b>	FBQ	.09	.05	−.01	.18	.09	.06
	NRT	1.58	.83	.10	3.10	.13	.10

\**p* < .05, STAI-C (trait anxiety), IB (interpretation bias).

Point biserial correlations revealed that cognitive rehearsal (thinking about the information and approach task vs. distracter task) did not significantly correlate with fear beliefs (FBQ) or

avoidance (NRT) (Table 3.5). Therefore, asking children to think about the information and approach task did not affect their cognitive or behavioural fear response towards the animals.

*Table 3.4: Test of moderation: Bias corrected bootstrap estimated regression coefficients and their standard errors (based on 1000 samples).*

Predictor	Outcome	<i>B</i>	<i>SE</i>	CI (lower)	CI (upper)	<i>p</i>	<i>R</i> <sup>2</sup>
	<b>FBQ</b>						.13
<b>STAIC</b>		.02	.03	−2.78	.67	.30	
<b>CR vs. D</b>		−.82	1.21	−.01	.10	.47	
<b>STAIC*CR</b>		.03	.04	−3.08	2.74	.45	
	<b>NRT</b>						.07
<b>STAIC</b>		.13	.28	−.25	.93	.41	
<b>CR vs. D</b>		−14.46	13.49	−41.52	20.18	.14	
<b>STAIC*CR</b>		.28	.41	−.54	.96	.39	

(CR vs. D = Cognitive rehearsal task vs. distracter task).

*Table 3.5: Summary of Point biserial correlation coefficients (sig 1-tailed) between cognitive rehearsal (whether children were asked to think about the information and approach task vs. the distracter task) and fear beliefs (FBQ) and avoidance (NRT)*

Variables		<i>r<sub>pb</sub></i>	<i>SE</i>	CI (Lower)	CI (Upper)	<i>P</i>	<i>R</i> <sup>2</sup>
<b>CR</b>	<b>FBQ</b>	.05	.14	−.24	.33	.35	.00
	<b>NRT</b>	−.18	.13	−.41	.13	.09	.03

3.3.5 *Hypothesis 4: Interpretation bias should predict biased memory and this relationship should be moderated by trait anxiety*

Hypothesis 4 was tested by performing simple regressions. The estimates and their standard errors of the regression coefficients were bias corrected bootstrapped based on 1000 samples.

Hypothesis 4 stated that interpretation bias would predict biased memory. This relationship was not found to be significant in Experiment 1 for any of the memory variables; however in the current experiment, this relationship was found to be significant for both ‘more negative’ and ‘false negative’ memory (Table 3.6). These findings suggest that children who disambiguate information in a more threatening way remember the information as being more negative and remember a greater amount of negative information that was not actually given relative to children who disambiguate the information in a non threatening way. It was also predicted that these relationships would be moderated by trait anxiety; in other words, trait anxiety would exacerbate the relationship between interpretation bias and biased memory. This hypothesis was tested by performing two separate multiple regressions; one with more negative memory as the outcome variable and one with false negative memory as the outcome variable and the predictors interpretation bias, trait anxiety and the interaction between trait anxiety and interpretation bias (Table 3.7). The independent regressions included IB, STAIC and also their interaction term (to test for moderation). The IB and STAIC predictors were centred before computing their interaction term. Centring is achieved by subtracting the mean of the variable from each value within that variable. The main advantages of centering are that it (1) reduces multicollinearity (high correlation) between the IB and STAIC predictors and the  $IB \times STAIC$  interaction term and (2) can provide more meaningful interpretations of the regression coefficients. In various

instances (such as this one), the predictors will not have a meaningful zero point and therefore, centering is necessary (<http://www.selfgrowth.com/articles/CenteringVariables to Reduce Multicollinearity.html>, extracted 23/09/09).

Two individual multiple regressions (Table 3.7) revealed that trait anxiety is a significant moderator of the relationship between interpretation bias and *more* negative memory; however, it is not a significant moderator of the relationship between interpretation bias and *false* negative memory. So, children who disambiguate information in a more threatening way encode this information more negatively in memory and this relationship is stronger for children who are more trait anxious than for less trait anxious children.

Further probing of this interaction using simple slopes analysis provides additional information to facilitate interpretation of the effect (Preacher, Curran, & Bauer, 2006). Specific values of (centered) trait anxiety were entered into an online utility to evaluate the effect of interpretation bias on more negative memory at specific conditional values of the moderator (trait anxiety).

These values (as recommended by Preacher et al. (2006)) were, at the mean and at 1 SD above and below the mean (i.e., where centered trait anxiety = 7.2, 0, and -7.2). A plot of these effects is shown in Figure 3.3, in which it can be seen that as trait anxiety increases, the slope relating interpretation bias to more negative memory becomes more positive. The simple slope is -0.0062 at -1 SD ( $p = .91$ , non significant), 0.109 at the mean of trait anxiety ( $p = .00$ , significant), and 0.2242 at +1 SD ( $p = .00$ , significant). These results indicate that the relationship between interpretation bias and more negative memory is significant only for children who have mid to high levels of trait anxiety and not for children who have relatively low levels of trait anxiety.

However, as the selection of  $\pm 1$  SD for trait anxiety is largely arbitrary, Preacher et al. (2006) suggest that of more interest are the values of trait anxiety for which the simple slope is statistically significant. The region of significance on the moderator (trait anxiety) ranges from  $-27.46$  to  $-2.28$ , indicating that any particular simple slope outside this range is statistically significant. Since centered trait anxiety ranges from approximately  $-12.91$  to  $18.09$ , this again suggests that the effect of interpretation bias on more negative memory is significant only for mid to high values of trait anxiety. Additionally, because the confidence bands in Figure 3.4 do not include simple slopes of zero for values of trait anxiety above  $-2.28$ , it can be concluded that the simple slope of more negative memory regressed on interpretation bias is significantly different from zero for values of trait anxiety above  $-2.28$ .

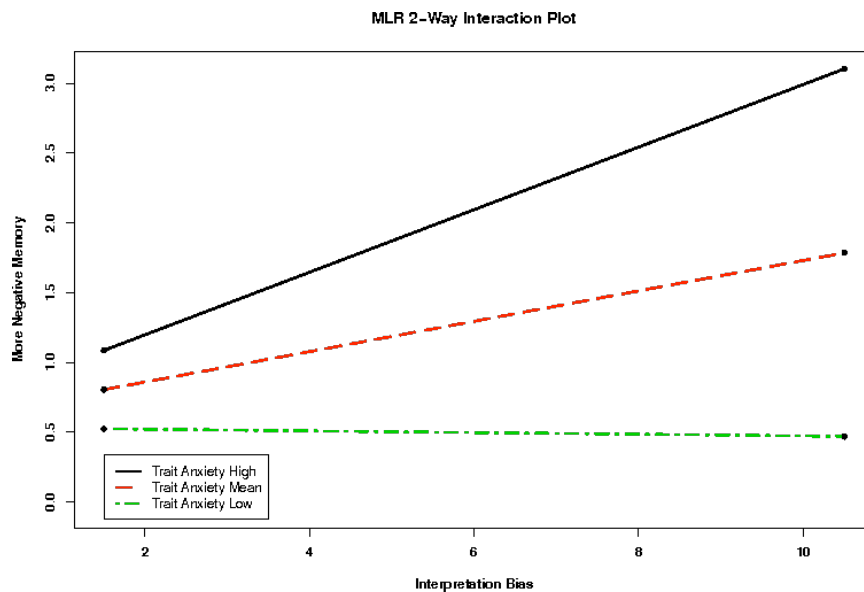


Figure 3.3: Mean plot illustrating the interaction of Interpretation Bias and Trait Anxiety. More negative slopes correspond to higher levels of Trait Anxiety.

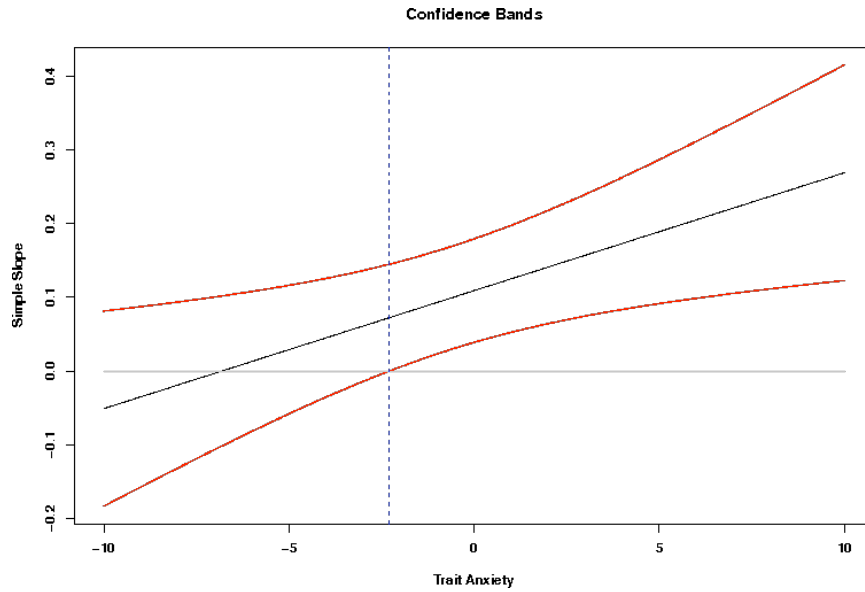


Figure 3.4: Plot illustrating confidence bands for observed sample values of trait anxiety.

Table 3.6: Bias corrected bootstrap estimated regression coefficients and their standard errors (based on 1000 samples) of five independent regressions that were run with a different outcome variable each time.

Predictor	Memory Outcome	<i>B</i>	<i>SE</i>	CI (lower)	CI (upper)	<i>p</i>	<i>R</i> <sup>2</sup>
IB	Accurate	.05	.08	-.12	.19	.55	.01
	More negative	.10*	.04	.02	.17	.04	.12
	More positive	-.02	.04	-.10	.04	.47	.01
	False negative	.13**	.04	.05	.20	.00	.16
	False positive	.00	.02	-.04	.05	.96	.00

\* $p < .05$  \*\* $p < .01$ , IB (interpretation bias)

Table 3.7: Multiple bias corrected bootstrap estimated regression coefficients and their standard errors (based on 1000 samples) were run to investigate whether trait anxiety moderated the relationship between interpretation bias and memory (more negative and false negative). (Centred variables)

Predictor	Memory Outcome	<i>B</i>	<i>SE</i>	CI (lower)	CI (upper)	<i>P</i>	<i>R</i> <sup>2</sup>
STAIC	More	.02	.01	-.01	.04	.24	.28
IB	Negative	.12*	.04	.05	.16	.01	



<b>STAIC×IB</b>		.02*	.01	.00	.03	.01	
<b>STAIC</b>	<b>False</b>	-.00	.01	-.03	.03	.91	.16
<b>IB</b>	<b>Negative</b>	.13*	.05	.04	.22	.01	
<b>STAIC×IB</b>		5.151E-5	.01	-.01	.01	.10	

\* $p < .05$

### 3.3.6 Hypothesis 5: Memory should mediate the relationship between Interpretation bias and Fear.

In Hypothesis 5 it was predicted that the relationship between interpretation bias and fear would be mediated by memory; specifically, interpretation bias should, as well as having a direct effect on fear, have an indirect effect via biased memory. For this mediation model to be true, (1) Interpretation bias should predict fear (NRT or FBQ or both) (which it does not, Table 3.3); (2) Memory should predict fear (which it does: more negative memory predicted avoidance (NRT) and both more negative memory and false negative memory predicted fear beliefs (FBQ) see Table 3.8) and (3) Interpretation bias should predict memory, which is the case for both the more negative and false negative memory variables (Table 3.6). However, the fact that there was no significant relationship between interpretation bias and fear (neither NRT or FBQ) obviously means that memory bias as a mediator could not be tested.

Table 3.8: Bias corrected bootstrap estimated regression coefficients and their standard errors (based on 1000 samples) of ten independent regressions that were run with a different outcome variable each time.

Memory Predictor	Outcome	<i>B</i>	<i>SE</i>	CI (lower)	CI (upper)	<i>p</i>	<i>R</i> <sup>2</sup>
<b>Accurate</b>	<b>NRT</b>	.75	.88	-.99	2.77	.28	.01
	<b>FBQ</b>	.03	.07	-.11	.22	.70	.00
<b>More Negative</b>	<b>NRT</b>	5.44	2.56	1.7	11.08	.05	.09
	<b>FBQ</b>	.54**	.17	.25	.87	.00	.20
<b>More Positive</b>	<b>NRT</b>	-4.53	2.48	-9.10	1.31	.07	.06
	<b>FBQ</b>	-.10	.14	-.45	.20	.36	.01
<b>False Negative</b>	<b>NRT</b>	4.52	3.26	-1.20	9.33	.43	.08
	<b>FBQ</b>	.43*	.15	.07	.69	.01	.15
<b>False</b>	<b>NRT</b>	-2.19	3.14	-9.94	2.62	.38	.01

Positive	FBQ	.07	.26	-.52	.51	.80	.00
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\* $p < .05$ , \*\* $p < .01$ , NRT (nature reserve), FBQ (change in fear beliefs)

### 3.4 Discussion

In contrast with Experiment 1, the current study found that trait anxiety predicted fear cognitions: children who are characterized by high trait anxiety became more fearful of the animals due to information than children who are less trait-anxious. This finding is consistent with what was predicted and with previous research (Field, 2006b; Field & Price-Evans, 2009), suggesting that high trait anxious children are more prone to the effects of verbal information than low trait anxious children, but what is the mechanism underlying this effect? It was predicted that high trait anxious children may interpret the information in a more threatening way (interpretation bias) thus causing them to become more fearful; however, in line with Experiment 1, this hypothesis was not supported: whether children disambiguated the information as threatening or as non threatening had no significant effect on their fear beliefs or avoidance.

Interestingly, the current study found as predicted, that children who disambiguate ambiguous information as threatening remember the information as being more negative than it was originally and remember more false negative pieces of information about the animals. The relationship between interpretation bias and more negative memory (but not false negative memory) was more pronounced for high trait anxious children than for low trait anxious children (the relationship between interpretation and memory is moderated by trait anxiety). Additionally children who remember ambiguous information as being more negative displayed more fear cognitions and avoidance behaviour towards the animals. These findings relate to Muris and Field's (2008) model which proposed that the cognitive biases are linked and may interact with each other at different stages of information processing and impact on feelings of fear and

anxiety. In other words, distortions at an early stage of processing (e.g., encoding) increase the likelihood of biases at subsequent stages of processing (e.g., interpretation) (Daleiden & Vasey, 1997).

With regard to the cognitive rehearsal manipulation, once again contrary to predictions, it was found that whether children (both high and low trait anxious) cognitively rehearsed ambiguous information about a novel animal or were prevented from doing so did not significantly affect their fear beliefs or avoidance. This finding is not in line with previous research which has shown that thinking in an iterative style is associated with poor problem solving skills, impaired motivation, and inhibition of instrumental behaviour (see Lyubomirsky & Tkach, 2004, for a review). It is worth noting, however, that in general children were having more threat thoughts about the animal than positive thoughts: the mean thought severity score fell into the ‘medium threat’ category and the range of thoughts was small (range = 2). This suggests that there was not a range of positive and negative thoughts and therefore it remains unknown what the effect of thinking threat thoughts vs. positive thoughts about the animals would be. To investigate this possibility it would be necessary to manipulate the content of the children’s animal related thoughts, i.e. by having two groups of children: one who were instructed to think exclusively negative thoughts about the animals and one group who were instructed to think exclusively positive thoughts about the animals. This manipulation would make it possible to look at the effect of thinking positively vs. thinking negatively about the animals.

An obvious limitation with the current experiment was the touch box task. The touch box used in both the current experiment and in Experiment 1 failed to produce analysable data. As described above in the results section, nearly all children were willing to put their fingers into all the holes along the tube leading into the animal boxes, thus producing a ceiling effect. This suggests that

the children were not afraid the animal inhabitants. However, this explanation seems unlikely due to the fact that many children expressed threat thoughts about the animal during the cognitive rehearsal task. A possible explanation for this ceiling effect is that maybe the children believed that the animal could not fit into the tube and would therefore be unable to harm them; they may have thought that the animal would not be able to reach its paw down the tube (the diameter of the tube was approximately 8 cm). Alternatively, the children may have imagined the animals to be extremely small and therefore able to crawl down the tube but would be too small to cause any harm- an estimation of the size of the animals was not given to the children.

Another possibility is that because the children were told in the ambiguous information that the animals are nocturnal, they may have thought that the animals would be asleep and that simply putting their finger into a hole a long way from the animal's bed would not be enough to wake them. In any case it would be necessary to adapt this task for future experiments by perhaps removing the tube leading from the animal boxes and instructing the children to place their hand directly into the animal box.

Another limitation of the first two experiments was that physiological fear responses were not measured. Lang (1968) famously conceptualized anxiety as three response systems: language behaviour (as measured by the FBQ), overt behaviour, such as behavioural avoidance (as measured by the Nature reserve task and behavioural avoidance task) and physiological responses. It would therefore be beneficial for future experiments to include a measure of the children's physiological responses by for example measuring heart rate whilst approaching the animal boxes.

## **4 Experiment 3: The Effect of Positive vs. Negative Cognitive Rehearsal**

### **4.1 Introduction**

In Experiment 2 high trait anxious children became more fearful of the animals due to the verbal information but this relationship was not mediated by interpretation bias nor was it moderated by manipulating cognitive rehearsal. Additionally, whether children (both high and low trait anxious) cognitively rehearsed ambiguous information about a novel animal or were prevented from doing so did not significantly affect their fear beliefs or avoidance. This finding suggests that cognitive rehearsal of information had no significant effect on fear; however, Experiment 2, did not take into account the content of children's thoughts. It appears that in general children were having more threat thoughts about the animal than positive thoughts: the mean thought severity score fell into the 'medium threat' category and the range of thoughts was small (range = 2). These data suggest that there was not a wide range of positive and negative thoughts and consequently the effect of thinking threat thoughts about the animals compared to thinking positive thoughts remains unknown. There is substantial evidence that the valence of thought content is a key factor in determining whether cognitive rehearsal will be constructive or unconstructive. For example, Segerstrom, Stanton, Alden, and Shortridge (2003) found that negative cognitive rehearsal was related to a poorer level of general mental health, greater anxiety, and greater physical symptoms. In a large meta-analysis, Mor and Winkvist (2002) discovered a strong association between focus on negative self-aspects and increased levels of negative affect, whereas focus on positive self-aspects was related to lower levels of negative affect. This research has shown that the process of cognitive rehearsal itself is not detrimental to mental health unless the nature of these thoughts is negative or threatening.

Experiments 1 and 2 have collectively shown that both high and low trait anxious children are equally as likely to cognitively rehearse ambiguous information and the severity of their thoughts does not significantly affect their fear. However, because the majority of children in these experiments had only mild threat thoughts, the effect of severe threat thoughts compared to severe positive thoughts remains unknown; we would expect that, based on Mor and Winquist's (2002) meta-analysis, cognitive rehearsal about threat should create anxiety.

Also, it is possible that if children were more varied in their thought content during the cognitive rehearsal task (e.g., if some children had positive thoughts and some had negative thoughts) then an effect of cognitive rehearsal on fear would have been found. The current experiment aims to explore this idea by experimentally manipulating thinking about ambiguous information in a positive way relative to a negative way by explicitly asking children to either think positively or negatively about the animals. This manipulation will allow us to obtain greater variability in thought severity scores during the cognitive rehearsal task and by manipulating the content of thoughts, it is possible to say something about the causal relationship between positive vs. negative thinking and fear. Based on the aforementioned research it was predicted that negative cognitive rehearsal would increase fear whereas positive cognitive rehearsal would reduce fear and this effect would vary as a function of trait anxiety.

In Experiments 1 and 2, only two of Lang's (1968) three fear response systems were measured, namely language behaviour and overt behaviour. The third fear response, physiological arousal, was not measured. Given the well-documented finding that the three fear response systems are not necessarily synchronous (Hodgson & Rachman, 1974; Lang, Melamed & Heart, 1970; Rachman & Hodgson, 1974; Zinbarg, 1998) it cannot be assumed that physiological responses would be affected in the same way as fear cognitions and avoidance behaviour. Therefore, all

three fear response systems will be measured in the current experiment. Language behaviour and overt behaviour will be measured in the same way as in the previous experiments and physiological arousal will be measured in the form of heart rate when the children are asked to approach the animals. Heart rate was chosen because it has been found to be a useful indicator of physiological arousal in child samples in previous experiments (Field & Schorah, 2007; Weems, Zakem, Costa, Cannon, & Watts, 2005). If verbal information has an effect on the physiological component of the fear emotion, then we would expect children's heart rate to increase when approaching animals about which they have heard ambiguous information.

As in Experiments 1 and 2, Experiment 3 has five main hypotheses, which differ only with regards to cognitive rehearsal: (1) Replicating Field (2006b), children who are more trait anxious, relative to children who are less trait anxious, would become more fearful of a novel animal after hearing some ambiguous information about it. (2) Because children who are more trait anxious have been found to disambiguate ambiguous information as more threatening (Field, 2006b), the relationship between trait anxiety and fear should be mediated by interpretation bias in other words, children who are more trait anxious would interpret the information as being more threatening and therefore become more fearful of the animals. (3) Negative cognitive rehearsal should increase fear, whereas positive cognitive rehearsal would reduce fear and this effect would vary as a function of trait anxiety. (4) Children who disambiguate the verbal information in a threatening way (interpretation bias) would subsequently encode the information more negatively into memory and therefore show a memory bias for the information and this relationship would be moderated by trait anxiety. (In other words, the relationship between interpretation and memory would be stronger for highly trait anxious children than for less trait anxious children.) (5) Finally it is predicted that memory

will mediate the relationship between interpretation bias and fear: children who interpret the information as being more threatening would also encode the information as being more threatening into memory which would lead to them becoming more fearful of the animals.

## **4.2 Method**

### *4.2.1 Design*

As in the previous experiments, two Australian marsupials were used in the current experiment: a quoll and a cuscus. Information was manipulated so that children heard some ambiguous information about one of the animals and no information about the other animal (counterbalanced across groups). Cognitive rehearsal was manipulated by asking children to think of either all the possible ‘good’ or ‘bad’ things that could happen to them when they put their hand in the box containing one of two animals (counterbalanced across groups).

The children’s thoughts were subsequently scored for severity, which could range from (severe negative thought) to 5 (severe positive thought). The outcome variables, as in Experiments 1 and 2, were: fear beliefs (Fear Beliefs Questionnaire, FBQ) and avoidance (Nature Reserve Task, NRT) both measured before and after the information was given and after the cognitive rehearsal phases of the experiment; behavioural avoidance (measured using a Behavioural Approach Task), memory of the information (measured using a free recall task and prompted memory questions), and interpretation of the ambiguous information (measured using both forced choice and free response questions). Trait anxiety was measured as a predictor using the State Trait Anxiety Inventory for Children, STAI-C (Spielberger, 1973).

### *4.2.2 Ethical Issues*

Ethical approval was obtained by the University of Sussex School of Life Sciences ethics committee (see appendix F). The experiment ran on a strict ‘opt- in’ only basis and children were



told at the start of the experiment that they could withdraw from the experiment at anytime. At the end of the experiment all children were fully debriefed.

#### 4.2.3 *Participants*

Seventy-eight children (23 boys, 55 girls) between the ages of 8 and 11 years ( $M = 123.33$  months,  $SD = 10.29$ ) took part. This age range was chosen because normative fears are focused on animals during this period (Field & Davey, 2001). Forty children were instructed to think about all the possible ‘bad’ things that could happen to them when they approach the animal boxes and put their hands in (26 girls and 14 boys) and 38 children were instructed to think of all the possible ‘good’ things that could happen when they approach the animal in the impending approach task (9 boys and 29 girls).

The children were enrolled from a school in West Sussex, U.K. Most pupils attending the school were from white British backgrounds and nearly all speak English as their home language.

Parents were sent letters (see appendix A) describing the procedures implicated in the experiment (but not the main purpose) along with a consent form (See appendix B) to return to the school if they would like their child to participate (the experiment ran strictly on an opt-in basis). Two hundred and thirty children were invited to participate, giving a response rate of 34%. On arrival to the experiment, children were reminded that they could withdraw at anytime.

#### 4.2.4 *Cognitive Rehearsal*

In Experiment 3 a variation of the cognitive rehearsal task was used to explore the effect(s) of manipulating thinking about ambiguous information in a positive relative to a negative way. Specifically, after hearing the ambiguous information, half of the children were instructed to think about all the possible ‘good’ outcomes of putting their hand in the animal box and half of the children were instructed to think of all the possible ‘bad’ outcomes of putting their hand in

the box. After 15 seconds, children in both groups were prompted to tell the experimenter what they had been thinking and their responses were audio recorded. The children were then asked to carry on thinking (either negatively or positively depending on the condition to which they were allocated) for a further 15 seconds before being asked to again tell the experimenter what they had been thinking. This procedure was repeated a further two more times (4 times in total) and all responses were audio recorded for later coding.

#### 4.2.5 *Behavioural Approach Task*

Due to the fact that in Experiments 1 and 2 almost every child was willing to put their finger into every hole of the animal box thus producing a ceiling effect that rendered the data unusable, it was concluded that this task was not a valid measure of avoidance behaviour. Therefore, in Experiment 3, this task was modified to resemble tasks used successfully in previous experiments (e.g., Field & Lawson, 2003). Specifically, the tube protruding from the pet carriers was removed and the entrance of the pet carriers was covered with a piece of fabric so that the child could put their hand in but could not see inside. As in Experiment 1, participants were told that the box contained an animal about which they had heard some information. The latency to place their hand into the box was used as a measure of behavioural avoidance (Field & Lawson, 2003).

#### 4.2.6 *Heart rate*

Heart rate was measured using a Cat Eye PL-6000 heart rate monitor, which has been successfully used in previous experiments with children (Field & Price-Evans, 2009). This monitor incorporates a sensor in a small non-invasive clip that could be fitted by the experimenter onto the child's ear lobe. The device was programmed to record the average heart

rate over a 15 second period whilst the child completed the behavioural approach task to provide a physiological measure of fear.

#### 4.2.7 *Ethical Issues*

Ethical approval was obtained by the University of Sussex School of Life Sciences ethics committee (see appendix F). The experiment ran on a strict ‘opt- in’ only basis and children were told at the start of the experiment that they could withdraw from the experiment at anytime. At the end of the experiment all children were fully debriefed.

#### 4.2.8 *Procedure*

The procedure for Experiment 3 was identical to that of Experiments 1 and 2 except for a few alterations. For instance, after hearing the ambiguous information, the experimenter told the children ‘In a few moments you are going to approach the animal boxes one at a time and place your hand inside and stroke the animals, but for now I would like you to sit quietly and think about all the possible ‘good’ or ‘bad’ (depending on which condition they were assigned to) outcomes of putting your hand in the animal boxes’. After 15 seconds, children in both groups were prompted to tell the experimenter what they had been thinking and their responses were audio recorded, this process was repeated four times so that children were thinking for a total of one minute. The procedure for the touch box task was also adapted in this experiment (see above), however the task was still completed at the same time point in the experiment as in Experiments 1 and 2. In the present experiment, the touch box task was administered to assess the children’s heart rate as a measure of their anxiety. The task began with the experimenter clipping the heart rate monitor gently onto the child’s ear. The children were then stood approximately 1 meter in front of the boxes and were instructed to approach the first box and place their hand into the hole in the front of the box and stroke the animal inside. After the child

had placed their hand in the box for 3 seconds, the examiner instructed them to withdraw their hand and return to the starting point. The mean heart rate during the time it took for the child to approach the box and put their hand inside was recorded. If the child had not put their hand into the box after 15 seconds, it was assumed that they did not want to approach the animal and the examiner instructed them to proceed to the next box. The child was then instructed to approach the second animal box and the average heart rate during the time it took them to approach the box and place their hand in was recorded; again, if the child had not approached the box within 15 seconds, it was assumed that they did not want to do the task and the experimenter proceeded onto the next task. This procedure follows that of previous experiments (e.g., Field & Schorah, 2006; Field & Price-Evans, 2009).

Fear beliefs, avoidance, memory and interpretations were all measured in the same way as in Experiments 1 and 2.

#### 4.2.9 *Coding*

The severity of children's thoughts, their interpretations and memory data were all coded by the experimenter and a sample of 20 data sets were second coded by an independent undergraduate Psychology student.

*Inter-rater reliability:* The inter-rater reliabilities were high and significant for the 'severity of animal related thoughts' in the cognitive rehearsal task, Cohen's  $\kappa = .87, p < .001$ , the interpretation of ambiguous information,  $\kappa = .79, p < .001$ , the prompted recall memory questions,  $\kappa = .77, p < .001$ , and the free recall memory task,  $\kappa = .70, p < .001$ . As in Experiment 1 and 2, inter-rater reliability was not measured for 'false memories' in the free recall task

because in the sample of 10 children whose data were second coded, there were too few false memories reported.

*Internal consistency data for Fear beliefs questionnaire, FBQ:* The internal consistencies for the FBQ in the current sample were high and consistent with values across several previous studies (see Field, 2006b) and also with Experiments 1 and 2: before information:  $\alpha = .78$  (cuscus subscale) and  $\alpha = .75$  (quoll subscale); and after information,  $\alpha = .91$  (cuscus subscale) and  $\alpha = .87$  (quoll subscale).

*Internal Consistency data for The State-Trait Anxiety Inventory for Children:* The STAI-C was found to have high reliability in the current sample,  $\alpha = .81$ .

### 4.3 Results

#### 4.3.1 Initial Analysis

*Interpretation bias data:* As in Experiments 1 and 2, it was found that the scores for the open response and forced choice interpretation questions were highly correlated, bias corrected bootstrapped Pearson's  $r = .40$ ,  $p < .001$  (two-tailed) and so the average of the open response and forced choice scores for each child was used as the measure of interpretation bias.

*Positive vs. negative thinking manipulation:* An independent samples  $t$ -test (based on 1000 bootstrap samples) was conducted to compare the thought severity scores of the negative and positive thinking conditions. A significant difference in severity scores was found for the negative ( $M = 3.40$ ,  $SD = 0.59$ ) and positive ( $M = 1.02$ ,  $SD = 0.56$ ) thinking conditions;  $t(74) = 18.11$ ,  $p < .01$  (severity scores could range from 0, indicating a very negative thought to 5, indicating a very negative positive). This finding shows that the cognitive rehearsal manipulation was successful in creating either more positive or more negative thoughts in the children.

*Table 4.1: Descriptive statistics of all the main variables*

	<i>N</i>	<b>Minimum</b>	<b>Maximum</b>	<i>M</i>	<i>SD</i>
STAI-C	78	22	54	36.37	7.03
FBQ	78	−1.63	2.88	.13	.83
NRT	78	−27.00	32.00	2.61	9.29
IB	78	1.00	14.00	6.09	3.05
False positive Memory	78	0.00	1.00	.08	.21
False Negative memory	78	0.00	1.50	.29	.45
More negative memory	78	0.00	3.00	.39	.66
Accurate memory	78	0.00	8.50	3.54	1.83
More Positive memory	78	0.00	1.50	.29	.40
CR	76	0.00	4.50	2.18	1.33

Table 4.2: Bias corrected bootstrap Pearson correlation coefficients and their Confidence Intervals (based on 1000 samples) for all main variables.

Variables		Pearson Correlation	CI (Lower, Upper)
STAI-C	FBQ	.01	-.24, .27
	NRT	.10	-.12, .33
	IB	.15	-.08, .38
	CR	.09	-.13, .31
	False Negative Memory	-.17	-.45, .13
	False Positive Memory	.12	-.07, .35
	More Negative Memory	-.05	-.28, .15
	Accurate Memory	-.03	-.28, .20
	More Positive Memory	.10	-.12, .33
FBQ	NRT	.58**	.38, .73
	IB	.20	-.04, .44
	CR	.04	-.18, .25
	False Negative Memory	-.03	-.24, .18
	False Positive Memory	-.04	-.24, .13
	More Negative Memory	.07	-.13, .27
	Accurate Memory	.07	-.14, .29
	More Positive Memory	.17	-.07, .39
NRT	IB	.13	-.14, .38
	CR	.03	-.17, .23
	False Negative Memory	-.11	-.28, .06
	False Positive Memory	-.21	-.42, .02
	More Negative Memory	.04	-.18, .25
	Accurate Memory	.08	-.18, .30
	More Positive Memory	.08	-.12, .26
IB	CR	-.18	-.39, .08
	False Negative	.34**	.08, .54
	False Positive	-.13	-.34, .13
	More Negative	.10	-.13, .31
	Accurate	-.13	-.34, .10
	More Positive	-.14	-.31, .07
CR	False Negative Memory	-.21	-.41, .04
	False Positive Memory	.07	-.11, .21
	More Negative Memory	-.06	-.28, .19
	Accurate Memory	-.07	-.28, .15
	More Positive Memory	-.04	-.25, .17
False Negative Memory	False Positive Memory	-.03	-.16, .13
	More Negative Memory	-.14	-.28, .03
	Accurate Memory	-.26*	-.42, -.07
	More Positive Memory	-.13	-.29, .04
False Positive Memory	More Negative Memory	-.10	-.21, .04
	Accurate Memory	-.17	-.31, -.06
	More Positive Memory	.07	-.14, .25
More Negative Memory	Accurate Memory	-.01	-.20, .23
	More Positive Memory	-.11	-.30, .12
Accurate Memory	More Positive Memory	.41**	.16, .62

\*\* Correlation is significant at the 0.01 level (2-tailed). \* Correlation is significant at the 0.05 level (2-tailed).

*Analysis:* Analyses were conducted by performing simple regressions unless stated otherwise. The estimates of the regression coefficients and their standard errors were bias corrected based on 1000 bootstrap samples.

#### 4.3.2 *Hypothesis 1: Trait anxiety should predict fear*

In line with the findings from Experiment 1, but contrary to expectations and Experiment 2, trait anxiety did not significantly predict fear beliefs or avoidance due to information (Table 4.3).

#### 4.3.3 *Hypothesis 2: Interpretation bias should mediate the relationship between trait anxiety and fear.*

Because no significant relationship was found between trait anxiety and fear (see hypothesis 1) this relationship could not be tested.

#### 4.3.4 *Hypothesis 3: Cognitive rehearsal should mediate the relationship between trait anxiety and fear.*

As with hypothesis 2, due to the fact that a significant relationship between trait anxiety and fear was not found, this relationship could not be tested. Indeed, trait anxiety was not found to predict interpretation bias or severity of thoughts during the cognitive rehearsal task significantly (Table 4.3) and similarly, cognitive rehearsal did not significantly predict fear beliefs or avoidance (Table 4.3) indicating that whether a child had severe negative animal related thoughts or severe positive thoughts had no significant bearing on how fearful of the animals they became. Also surprising was that interpretation bias did not significantly predict fear: whether children interpreted the information as threatening or as not threatening was not predictive of how fearful of the animals they would be (Table 4.3). Additionally, and once again contrary to expectations, trait anxiety did not significantly predict increased heart rate when approaching the animal boxes or time to approach the animal boxes (Table 4.3).



Table 4.3: Bias-corrected regression coefficient estimates and their standard errors based on 1000 bootstrap samples.

Predictor	Outcome	<i>b</i>	<i>SE</i>	CI (lower)	CI (upper)	<i>P</i>	<i>R</i> <sup>2</sup>
STAI-C	FBQ	.00	.01	-.02	.03	.90	.00
	NRT	.12	.14	-.16	.39	.38	.01
	IB	.08	.05	-.02	.18	.11	.03
	CR	-.02	.02	-.06	.02	.37	.01
	Touch box	.01	.04	-.07	.09	.91	.00
	Heart rate	-.13	.27	-.63	.44	.62	.00
IB	FBQ	.05	.04	-.01	.13	.19	.04
	NRT	.24	.41	-.48	1.15	.63	.01
	Touch box	.09	.08	-.03	.26	.24	.02
	Heart rate	.13	.66	-1.26	1.36	.87	.00
CR	FBQ	-.03	.07	-.17	.13	.72	.00
	NRT	-.20	.74	-1.68	1.27	.79	.00
	Touch box	.30	.18	-.01	.67	.11	.04
	Heart rate	-.89	1.52	-3.91	2.12	.54	.01

#### 4.3.5 Hypothesis 4: Interpretation Bias should predict Memory Bias and this relationship should be moderated by trait anxiety

In line with Experiment 2, interpretation bias was found to significantly predict false negative memory (Table 4.4). However, unlike in Experiment 2, interpretation bias did not significantly predict the number of more negative memories. It was predicted in hypothesis 4 that trait anxiety would moderate the relationship between interpretation bias and biased memory; in other words, trait anxiety would exacerbate the relationship between interpretation bias and biased memory. This was tested as in Experiment 2 by predicting false negative memory from trait anxiety, interpretation bias and the interaction between trait anxiety and interpretation bias (Table 4.5). The regressions included IB, STAIC and also their interaction term (to test for moderation). The IB and STAIC predictors were centred before computing their interaction term. Table 4.5 shows that interpretation bias has a significant positive relationship with false negative memory but this relationship is not significantly moderated by trait anxiety. Therefore, children who interpret ambiguous information as threatening will encode more false negative information into memory regardless of levels of trait anxiety.

Table 4.4: Bias-corrected regression coefficient estimates and their standard errors based on 1000 bootstrap samples.

Predictor	Memory Outcome	<i>b</i>	<i>SE</i>	CI (lower)	CI (upper)	<i>p</i>	<i>R</i> <sup>2</sup>
IB	Accurate	−.07	.07	−.21	.06	.30	.02
	More negative	.02	.03	−.03	.08	.59	.01
	More positive	−.02	.01	−.04	.01	.10	.02
	False negative	.04*	.02	.01	.07	.03	.08
	False positive	−.01	.01	−.03	.01	.20	.02

\**p* < .05

#### 4.3.6 Hypothesis 5: Memory should mediate the relationship between interpretation bias and fear

Hypothesis 5 stated that memory should mediate the relationship between interpretation bias and fear. However in line with Experiments 1 and 2, no significant relationship was found between interpretation bias and fear and therefore this hypothesis could not be tested (Table 4.3).

Unexpectedly, biased memory did not significantly predict any of the fear responses, yet accurate memory had a significant positive relationship with time to approach the touch box, (Table 4.6). This finding is not in line with Experiment 1, which found that false positive memories were negatively related to change in fear beliefs, or Experiment 2, which found that both the false negative and more negative memory variables were positively related with change in fear beliefs due to information.

Table 4.5: Bias-corrected regression coefficient estimates and their standard errors based on 1000 bootstrap samples. The outcome variable: False negative memory.

Predictor	<i>b</i>	<i>SE</i>	CI (lower)	CI (upper)	<i>p</i>	<i>R</i> <sup>2</sup>
STAI-C	−.02	.01	−.03	−.00	.12	.14
IB	.05*	.02	.02	.07	.02	
STAIC*IB	−.00	.00	−.01	.01	.80	

\**p* < .05

Table 4.6: Bias-corrected regression coefficient estimates and their standard errors based on 1000 bootstrap samples

Memory Predictor	Outcome	<i>b</i>	<i>SE</i>	CI (lower)	CI (upper)	<i>p</i>	<i>R</i> <sup>2</sup>
Accurate	NRT	.44	.59	-.74	1.68	.46	.01
	FBQ	.03	.05	-.06	.14	.57	.01
	Touch box	.15*	.09	-.02	.35	.03	.02
	Heart rate	1.07	1.14	-1.05	3.50	.41	.01
More Negative	NRT	.63	1.55	-2.50	3.20	.65	.00
	FBQ	.29	.13	-.16	.30	.40	.01
	Touch box	-4.50	.29	-.35	.86	.21	.01
	Heart rate	1.66	2.86	-10.23	2.57	.09	.03
More Positive	NRT	1.66	2.21	-2.73	6.53	.36	.01
	FBQ	.34	.22	-.07	.78	.09	.03
	Touch box	.62	.55	-.49	1.65	.25	.02
	Heart rate	6.21	5.14	-3.25	16.66	.19	.02
False Negative	NRT	-2.15	1.99	-6.38	2.11	.19	.01
	FBQ	-.05	.22	-.47	.35	.82	.00
	Touch box	.38	.41	-.36	1.12	.24	.01
	Heart rate	2.35	4.08	-5.78	9.62	.51	.00
False positive	NRT	-8.88	5.92	-23.13	.10	.17	.04
	FBQ	.14	.10	-.05	.35	.17	.00
	Touch box	-.89	1.08	-3.41	.61	.35	.01
	Heart rate	2.93	13.30	-29.48	19.32	.85	.00

\* $p < .05$

#### 4.4 Discussion

Contrary to what was expected, but in line with Experiment 1, the present study indicates that high levels of trait anxiety did not significantly predict change in any of Lang's (1968) three response systems of the fear emotion in children: avoidance behaviour, fear cognitions and physiological arousal. This finding is inconsistent with Experiment 2 in which it was found that children who were more trait anxious became more fearful and avoidant of the animals due to the information provided. The current finding is also inconsistent with previous research (e.g., Field, 2006b; Field & Price-Evans, 2009) showing that trait anxiety moderates the effect of threat information on fear. In these studies, children high on trait anxiety showed greater avoidance and attentional bias towards previously novel animals after experiencing verbal information.

However, as also noted in the discussion of Experiment 1, Field (2006b) and Field and Price-

Evans (2009) used threat information whereas ambiguous information was used in the current study, which could explain this inconsistency; however, this observation does not explain why a significant result was found in Experiment 2.

Nevertheless, we predicted that anxious children should interpret the ambiguous information in a more threatening way and this did not appear to be the case in any of the three experiments. This finding is not only inconsistent with what was predicted but also with a growing body of research which has demonstrated that high trait anxious children *do* show a tendency for interpreting ambiguous stimuli as threatening (Bögels & Zigterman, 2000; Hadwin et al., 1997; Muris, Merckelbach et al., 2000; Muris & van Doorn, 2003; Taghavi et al., 2000; Lester, et al., 2010). Additionally, this finding is inconsistent with the adult literature, which has found considerable evidence that high trait anxious and individuals with anxiety disorders show a disproportionate tendency to interpret ambiguous cues as threatening (e.g. Beck et al., 1985; Eysenck, 1997; Mogg & Bradley, 1998; Williams et al., 1997).

As predicted, children who disambiguated the information as threatening encoded more *false* negative pieces of information into memory; this relationship was also found in Experiment 2 but not in Experiment 1. Contrary to our predictions, but consistent with Experiments 1 and 2, this relationship was not moderated by trait anxiety. However, in Experiment 2 but not in the current experiment, children who interpreted the information as threatening encoded the information into memory as being *more* negative (as well as remembering *false* negative information) than it was originally and this relationship *was* moderated by trait anxiety.

It was hypothesized that biased memory would predict an increase in all three of Lang's (1968) fear response systems yet this was not found to be the case for any of the fear responses. What

was found however was that accurate memory recall predicted greater behavioural avoidance in the form of a greater latency to approach the animal box. These findings are inconsistent with Experiment 1, which found that a greater number of false positive memories predicted a decrease in fear beliefs, and Experiment 2, which found that children who remembered the information as being more negative than it was originally had more fear cognitions about the animals.

The present findings indicate that the content of the children's thoughts during the cognitive rehearsal task had no significant impact on their levels of fear or avoidance. In other words, whether a child had severe negative animal-related thoughts or severe positive animal-related thoughts had no significant bearing on how fearful of the animals they became. These findings are surprising due to a large body of evidence in adults indicating that the valence of thought content is a key factor in shaping whether cognitive rehearsal will have a positive or negative effect on the mental health of the individual. For example, Segerstrom et al. (2003) have found that a more negative content of thoughts during cognitive rehearsal is related to greater anxiety levels and a larger number of physical symptoms. Martin and Tesser (1996) recognized that cognitive rehearsal contains several subclasses or modes, including repetitive thought about positive content or about negative content, suggesting that content of thoughts during cognitive rehearsal are not just negative. Moreover, in a large meta-analysis of the self-focus literature it was found that attention to negative aspects of the self was strongly associated with a greater degree of negative affect, whereas attention to positive aspects of the self was associated with lower levels of negative affect (Mor & Winquist, 2002). Thus, the valence of thought content during cognitive rehearsal appears to be a major determinant of whether cognitive rehearsal has constructive or unconstructive consequences. However, this was not found to be the case in the current experiment.

It was also predicted that the effect of positive vs. negative cognitive rehearsal on fear would vary as a function of trait anxiety although this was not found to be the case. This result is inconsistent with past research on adults: for example, Nolen-Hoeksema and Morrow (1993) found that mildly-to-moderately depressed individuals became significantly more depressed after an 8 minute cognitive rehearsal task and significantly less depressed after an 8 minute distraction task whereas the mood of non-depressed participants was not significantly affected by cognitive rehearsal or distraction. Our failure to find a significant effect of cognitive rehearsal on anxiety could be partly due to the fact that the current experiment used children whereas the aforementioned studies used adults. For example, our children may not yet have reached the level of cognitive development necessary for the process of cognitive rehearsal to have an impact on fear. However, this explanation seems unlikely due to the fact that the children used in the current study were 8-11 years old and research has shown that anxious youth of this age frequently present with anxiety disorders and express a tendency to cognitively rehearse possible negative outcomes and feared events (Comer et al., 2004). Additionally, there is evidence which suggests that children may be capable of engaging in an adult-like worry process as young as 7 or 8 years of age (Vasey & Daleiden, 1994; Bacow, Pincus, Ehrenreich & Brody, 2009), and that this ability to worry is linked to the developing meta-cognitive understanding that children in this age range possess (Flavell, Green, & Flavell, 1995; Muris, Merckelbach, Meesters, & van den Brand, 2002). In fact, meta-cognitive knowledge about strategies and tasks is thought to come about once children start school, and is possibly linked to the onset of the concrete operational stage which usually emerges in children at age 7 (Piaget, 1970).

An alternative explanation might be that because children were asked to think of all the possible good or bad (depending on the group to which they were assigned) things that could happen to

them when they approached the animal box, their answers may not have been a true reflection of how they actually felt about the animals or what they really believed would happen when they approached the animals. Nolen-Hoeksema and Davis (1999) have indicated that a repetitive style of thinking appears to be a stable individual difference characteristic, which has been hypothesized to be learnt in childhood, either because it was modelled by parents who themselves had a passive coping style (Nolen-Hoeksema, 1991; Nolen-Hoeksema, Mumme, Wolfson, & Guskin, 1995) or because the child failed to learn more active coping strategies for negative affect as a consequence of overcritical, intrusive, and over controlling parents (Nolen-Hoeksema et al., 1995). It is feasible then that the children in the current sample had already developed active coping strategies as modelled by their parents, which may have protected them from the effects of cognitively rehearsing possible negative outcomes with the animals. Another possibility, based on the aforementioned research is that to have any effect on fear, the process of cognitive rehearsal needs to be learned over a longer period of time. For example, children in the current experiment cognitively rehearsed for only one minute and this was broken down into four sets of 15 seconds each whereas participants in Nolen-Hoeksema and Morrow (1993) cognitively rehearsed for a solid period of 8 minutes. Future experiments with children could extend the length of the cognitive rehearsal task to a period of 8 minutes or perhaps look at the effect of cognitive rehearsal manipulation over a period of multiple sessions. Future work also needs to look at cognitive rehearsal longitudinally, which would provide a better understanding of the natural development of cognitive rehearsal in children over time.

Although Experiments 1, 2 and 3 have produced some consistent findings, there have also been many inconsistent results amongst them leading to confusion as to what the true effects might be. Due to the fact that all three experiments employed very similar procedures with the only

variation between them being the cognitive rehearsal task, it would be beneficial to combine these data to produce a larger sample ( $N=187$ ). Larger samples are more representative of the population and add precision to the regression coefficient estimates thus providing a more accurate picture of the true relationships between the variables measured across the three experiments.



## **5 Analysis of Combined Data From Experiments 1, 2 and 3**

### **5.1 Introduction**

Experiments 1, 2 and 3 found fairly inconsistent results; it is possible that some of these inconsistencies are due to the relatively small sample sizes of each individual experiment. For example, estimates of population statistics tend to fluctuate more in smaller samples than larger ones (Field, 2009). Larger samples also provide greater statistical power; for example, with a sample of 55, the previous experiments would have had the power to detect only medium to large effects (Field, 2009). It was therefore decided to combine data from all three experiments to produce a relatively large data set ( $N = 187$ ), which would generate parameter estimates that are more precise and representative of the population. Combining the data was made possible by the fact that the designs of Experiments 1, 2 and 3 were virtually identical, the only difference among them being that they each looked at a different variation of the cognitive rehearsal manipulation. Although the cognitive rehearsal manipulation was slightly different in each experiment, it was possible to combine these data because the methods for scoring and coding the severity of thoughts were comparable across the three studies.

As in Experiments 1, 2 and three, there are five main hypotheses: (1) Replicating Field (2006b), children who are more trait anxious, relative to children who are less trait anxious, would become more fearful of a novel animal after hearing some ambiguous information about it. (2) Because children who are more trait anxious have been found to disambiguate ambiguous information as more threatening (Field, 2006b), the relationship between trait anxiety and fear should be mediated by interpretation bias in other words, children who are more trait anxious would interpret the information as being more threatening and therefore become more fearful of

the animals. (3) The relationship between trait anxiety and fear should also be mediated by how children think about the information: children who are more trait anxious are predicted to cognitively rehearse the ambiguous information and in doing so derive a more negative meaning from it, leading them to become more fearful of the animals. (4) Children who disambiguate the verbal information in a threatening way (interpretation bias) would subsequently encode the information more negatively into memory and therefore show a memory bias for the information and this relationship would be moderated by trait anxiety. (In other words, the relationship between interpretation and memory would be stronger for highly trait anxious children than for less trait anxious children.) (5) Finally it is predicted that memory will mediate the relationship between interpretation bias and fear: children who interpret the information as being more threatening would also encode the information as being more threatening into memory which would lead to them becoming more fearful of the animals.

## 5.2 Method

The data from participants in Experiments 1, 2 and 3 were combined into one data set producing a sample size of ( $N=187$ ). The combined sample consisted of 71 boys and 116 girls between the ages of 8 and 11 years ( $M = 120.82$  months,  $SD = 10.53$ ). As mentioned above, it was possible to combine the cognitive rehearsal data from the three experiments even though the cognitive rehearsal manipulation was slightly different in each experiment because the methods for scoring and coding the severity of thoughts were kept constant across the three studies. Therefore, in the current analyses the cognitive rehearsal variable represents the children's mean thought severity score (severity of animal thought – severity of non-animal thought).

## 5.3 Results

### 5.3.1 *Initial Analysis*

*Measures of Fear (NRT and FBQ):* It was found that the NRT and FBQ scores were highly correlated;  $r = .44$ ,  $p < .001$  and because the sample size was fairly large ( $N = 187$ ) it was decided to combine these variables to create a latent variable 'Fear'. Figure 5.1 illustrates the general model that was used when analyzing 'fear' (unless otherwise stated). The box labelled 'predictor' was replaced with a different variable each time the analysis was run. The regression parameters and standard errors (and, therefore, confidence intervals) were bias-corrected based on 1000 bootstrap samples. All analyses were run in AMOS 16. When a latent variable was not used, for example for the memory data, detailed descriptions of the analysis that was used will be provided.

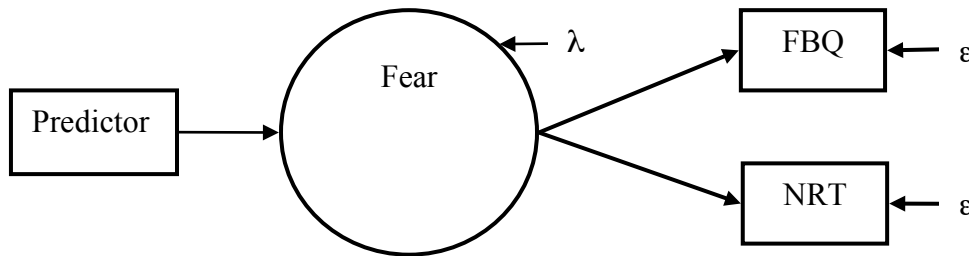


Figure 5.1: a path diagram showing how the latent variable 'fear' was created from the NRT and FBQ variables.

*Memory Variables:* A principal components analysis (PCA) was conducted on the 10 memory variables with orthogonal rotation (varimax). An initial analysis was run to obtain eigenvalues for each component in the data. Five components had eigenvalues over Kaiser's criterion of 1 and in combination explained 68.52% of the variance. Table 5.1 shows the factor loadings after rotation. The result was five factors that related very clearly to: accurate, more positive, more negative, false positive and false negative memories. Each component had two variables that loaded onto it: the free and prompted versions. Therefore, as mentioned in Chapter 2, five new

variables were created for use in all of the analyses in this and previous chapters. These variables were created by taking the average of the free and prompted recall memory variables, the resulting memory variables were: accurate, more negative, more positive, false negative and false positive memories.

*Table 5.1: Summary of exploratory factor analysis results for the 10 memory variables.*

<b>Memory Variable</b>	<b>Rotated Factor Loadings</b>				
	<b>Accurate</b>	<b>More Negative</b>	<b>False Negative</b>	<b>More Positive</b>	<b>False positive</b>
<b>Prompted recall Accurate</b>	.83				
<b>Free recall Accurate</b>	.82				
<b>Prompted recall More negative</b>		.86			
<b>Free recall More Negative</b>		.85			
<b>Prompted recall False Negative</b>			.78		
<b>Free recall False Negative</b>			.76		
<b>Prompted recall More positive</b>				.85	
<b>Free recall More Positive</b>				.71	
<b>Prompted recall False Positive</b>					.84
<b>Free recall False Positive</b>					.56
<b>Eigenvalues</b>	1.88	1.50	1.25	1.16	1.06
<b>% of variance</b>	18.77	14.96	12.55	11.62	10.62

*Table 5.2: Descriptive statistics of all the main variables*

	<i>N</i>	<b>Minimum</b>	<b>Maximum</b>	<i>M</i>	<i>SD</i>
STAI-C	187	22	54	36.53	6.87
FBQ Effect	187	-1.63	4.13	.26	.86
NRT Effect	187	-43.00	62.00	2.76	12.80
Interpretation Bias	187	.00	14.00	5.15	2.94
CR	136	.00	5.00	3.22	1.19
False Positive Memory	187	.00	2.00	.16	.36
False Negative Memory	187	.00	3.00	.34	.55
More Negative Memory	187	.00	3.00	.49	.64
Accurate Memory	187	.00	8.50	3.13	1.69
More Positive Memory	187	.00	3.00	.58	.60

Table 5.3: Bias corrected bootstrap Pearson correlation coefficients and their Confidence Intervals (based on 1000 samples) for all main variables

Variables		Pearson Correlation	CI (Lower, Upper)
STAI-C	FBQ	.11	-.05, .27
	NRT	.09	-.05, .24
	IB	.08	-.09, .25
	CR	-.02	-.09, .25
	False Negative Memory	-.09	-.17, .15
	False Positive Memory	.08	-.25, .06
	More Negative Memory	.00	-.17, .18
	Accurate Memory	-.05	-.21, .10
	More Positive Memory	.03	-.11, .18
FBQ	NRT	.44**	.22, .62
	IB	.21**	.02, .38
	CR	-.11	-.26, .04
	False Negative Memory	.12	-.07, .29
	False Positive Memory	-.05	-.17, .12
	More Negative Memory	.10	-.07, .27
	Accurate Memory	.04	-.12, .21
	More Positive Memory	.18*	.04, .33
NRT	IB	.13	-.03, .32
	CR	-.06	-.22, .11
	False Negative Memory	-.08	-.22, .06
	False Positive Memory	-.20*	-.43, .04
	More Negative Memory	.05	-.09, .18
	Accurate Memory	.03	-.13, .18
	More Positive Memory	.00	-.15, .16
IB	CR	-.23**	-.37, -.08
	False Negative	.26**	.09, .42
	False Positive	-.13	-.27, .02
	More Negative	.08	-.08, .22
	Accurate	-.06	-.21, .10
	More Positive	-.28**	-.42, -.13
CR	False Negative Memory	-.19*	-.32, -.03
	False Positive Memory	.05	-.15, .25
	More Negative Memory	-.10	-.27, .07
	Accurate Memory	.00	-.16, .16
	More Positive Memory	.10	-.06, .25
False Negative Memory	False Positive Memory	-.02	-.15, .13
	More Negative Memory	-.04	-.18, .12
	Accurate Memory	-.14	-.26, .02
	More Positive Memory	-.01	-.14, .13
False Positive Memory	More Negative Memory	.05	-.11, .23
	Accurate Memory	-.18*	-.28, -.05
	More Positive Memory	.00	-.15, .18
More Negative Memory	Accurate Memory	.08	-.07, .23
	More Positive Memory	-.03	-.16, .14
Accurate Memory	More Positive Memory	.19*	.05, .31

\*\* Correlation is significant at the 0.01 level (2-tailed). \* Correlation is significant at the 0.05 level (2-tailed).

*Analysis:* Analyses were conducted by performing regressions unless stated otherwise. The estimates and their standard errors of the regression coefficients were bias corrected bootstrapped based on 1000 samples.

### 5.3.2 *Hypothesis 1: Trait anxiety should predict fear*

Hypothesis 1 stated that trait anxiety would predict fear and Table 5.4, shows that this hypothesis is supported: the more trait anxious the child, the more fearful they became of the animals following the information.

### 5.3.3 *Hypothesis 2: Interpretation bias should mediate the relationship between trait anxiety and fear*

It was also predicted that the relationship between trait anxiety and fear would be mediated by interpretation bias; specifically, a child who is more trait anxious is more likely to interpret information in a negatively biased way and this interpretation bias creates an increase in fear (in other words trait anxiety should, as well as having a direct effect on fear, have an indirect effect via interpretational biases). For this mediation model to be true, (1) trait anxiety should predict fear (which it does); (2) interpretation bias should predict fear (which is also true – Table 5.4 shows that as interpretation bias increases so does the change in fear due to information), and (3) trait anxiety should significantly predict interpretation bias, which was not the case (Table 5.4). The fact that trait anxiety does not significantly predict interpretation biases means that interpretation biases do not mediate the relationship between trait anxiety and the change in fear towards the animals.

Given that trait anxiety predicts fear and interpretation biases do not mediate this relationship, perhaps interpretation biases *moderate* the relationship between trait anxiety and fear. In other words, fear is exacerbated by a combination of trait anxiety and interpretation bias. This

hypothesis was tested by predicting fear from trait anxiety, interpretation bias and the interaction between trait anxiety and interpretation bias (Figure 5.2). The independent regressions included IB, STAI-C and also their interaction term (to test for moderation), the IB and STAIC predictors were centred before computing their interaction term. Looking at Figure 5.2, it appears that there was some evidence for a moderation model: interpretation bias has a main effect in predicting fear and the interaction between interpretation bias and STAI-C was significant when not bootstrapped ( $b = .01, p = .04$ ) and nearly significant when bias corrected and bootstrapped ( $b = .01, p = .08$ ).

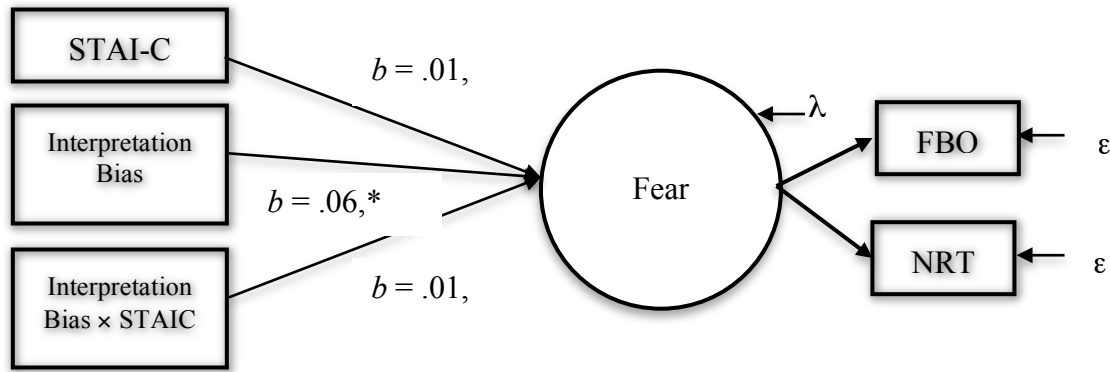


Figure 5.2: Moderation model displaying the unstandardized beta estimates based on 1000 bias corrected bootstrap samples. \*  $p < .05$



**Table 5.4:** Bias-corrected regression coefficient estimates and their standard errors based on 1000 bootstrap samples. Trait anxiety (STAI-C), Interpretation bias (IB) and Cognitive rehearsal (CR).

Predictor	Outcome	<i>B</i>	<i>SE</i>	95% CI (lower)	95% CI (upper)	<i>p</i>	<i>R</i> <sup>2</sup>
STAI-C	Fear	.02*		.00	.03	.01	
	IB	.04	.03	-.03	.10	.24	.01
	CR	.00	.02	-.02	.03	.88	.00
IB	Fear	.06*		.01	.11	.01	
CR	Fear	.08	.06			.19	
	IB	.55*	.20	-.15	.95	.01	.05

\* $p < .05$

#### 5.3.4 Hypothesis 3: The relationship between trait anxiety and fear would be mediated by cognitive rehearsal

This hypothesis predicted that anxious children would be more likely to cognitively rehearse the ambiguous information, which would then lead them to feel more fearful towards the animal. However, looking at Table 5.4, trait anxiety did not significantly predict cognitive rehearsal and cognitive rehearsal did not significantly predict fear. Therefore, cognitive rehearsal does not mediate the relationship between trait anxiety and fear of the animals. However, cognitive rehearsal was found to predict interpretation bias: children who had more severely negative thoughts about the animals were significantly more likely to interpret the ambiguous information as threatening than children who had less negative thoughts or indeed positive thoughts.

#### 5.3.5 Hypothesis 4: Interpretation bias should predict biased memory and this relationship should be moderated by trait anxiety

Hypothesis 4 stated that interpretation bias would predict biased memory and this relationship would be moderated by trait anxiety. In other words, children who interpret the information more negatively are more likely to encode and store the information more negatively in memory and this relationship will be stronger for trait anxious children than for non-trait anxious children.

Multiple regressions were run on these data with a different outcome (memory) variable each time. The sample estimates (betas, standard error, and 95% confidence intervals) were based on 1000 bias-corrected bootstrap samples. The independent regressions included IB, STAI-C and also their interaction term (to test for moderation); the IB and STAIC predictors were centred before computing their interaction term (see above).

These analyses tell us whether the effects of interpretation biases on memory exist when controlling for trait anxiety, and also look at whether trait anxiety moderates the effect of interpretation biases on memory. Looking at Table 5.5 below it seems that: (1) Interpretation bias had no significant effect on accurate memory recall or more negative memories; (2) Interpretation bias had a significant negative relationship with more positive memories and false positive memories; (3) Interpretation bias has a significant positive relationship with false negative memories; and (4) Trait anxiety did not significantly moderate these effects at all.

Table 5.5: Bias-corrected regression coefficient estimates and their standard errors based on 1000 bootstrap samples. Trait anxiety (STAI-C) and Interpretation bias (IB).

Predictor	Memory Outcome	<i>B</i>	<i>SE</i>	95% CI (lower)	95% CI (upper)	<i>P</i>	<i>R</i> <sup>2</sup>
STAI-C	Accurate	-.01	.02	-.04	.02	.69	.01
IB		-.02	.04	-.11	.07	.73	
STAIC*IB		-.01	.01	-.02	.01	.23	
STAI-C	More Negative	-.00	.01	-.02	.01	.79	.01
IB		.02	.02	-.01	.05	.33	
STAIC*IB		.00	.00	-.00	.01	.39	
STAI-C	More positive	.01	.01	-.01	.02	.40	.07
IB		-.05**	.01	-.08	-.02	.00	
STAIC*IB		-.00	.00	-.01	.00	.16	
STAI_C	False Negative	-.01	.01	-.02	.00	.12	.07
IB		.05**	.01	.02	.70	.00	
STAIC*IB		-.00	.00	-.01	.00	.22	
STAI_C	False Positive	.00	.00	-.01	.01	.79	.02
IB		-.02**	.01	-.03	-.00	.00	
STAIC*IB		.00	.00	-.00	.00	.89	

\* $p < .05$ , \*\* $p < .01$

### 5.3.6 Hypothesis 5: Memory should mediate the relationship between Interpretation bias and fear

Hypothesis 5 stated that memory should mediate the relationship between interpretation bias and fear, in other words children who interpret the information more negatively will encode this information more negatively into memory and this memory bias will then have the effect of increasing their fear of the animal. To test this, (based on Baron and Kenny, 1986) it is necessary for interpretation biases to predict fear (the direct effect), which was indeed found to be the case (see Table 5.4). Additionally, interpretation biases are required to predict memory and this appeared to be true for more positive memories; the greater the child's IB, the fewer positive memories were made, false negative memories; the greater the child's IB, the more false negative memories were made and false positive memories; the greater the child's IB, the fewer

false positive memories were encoded (see Table 5.5). Therefore these three memory variables can be tested as mediators, see Figure 5.3 below.

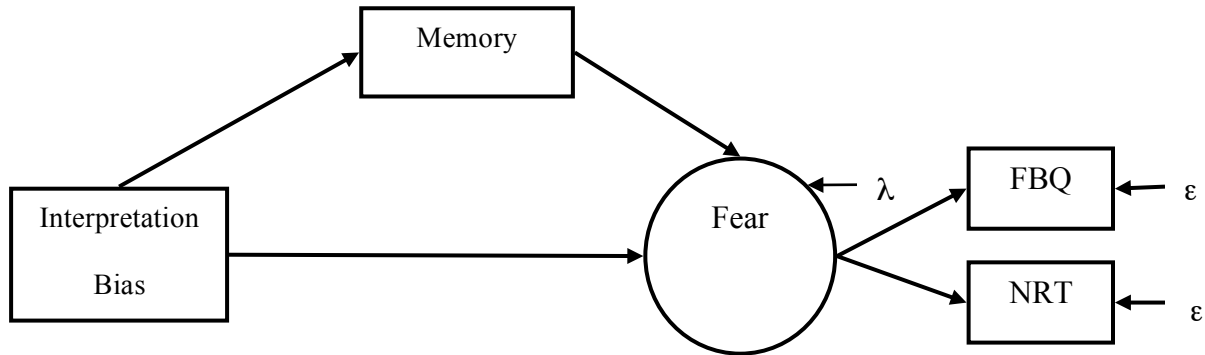


Figure 5.3: General mediation model in which memory mediates the relationship between interpretation bias and fear.

The model in Figure 5.3 was tested in which ‘memory’ was replaced in turn with ‘more positive’ ‘false positive’ and ‘false negative’. In each case, the indirect effect of interpretation bias on fear was tested using a bias corrected confidence interval based on 500 bootstrap samples in AMOS 16. The term ‘indirect effect’ is used because it is predicted that interpretation bias causes biased memory (mediator variable), which in turn causes fear, therefore it is predicted that interpretation bias has an indirect effect on fear via biased memory. For all indirect effects, significance was ascertained from the bias-corrected 95% confidence interval (based on 500 bootstrap samples). It was found that: (1) for ‘more-positive memories’ there was a significant mediation effect, 95% CI  $(-.03, -.00)$ ,  $(p = .02)$ ; (2) For ‘false-positive memories’ there was no significant mediation effect, 95% CI  $(-.01, .08)$ ,  $p = .13$ , this finding is complicated slightly by the fact that when testing the unstandardized betas the mediation effect was almost significant ( $p = .05$ ); (3). For ‘false-negative memories’ there was no significant mediation effect, 95% CI  $(-.02, .10)$ ,  $p = .18$ .

The link between IB and fear is mediated only by fewer positive memories. False-negative memories did not significantly mediate the link between interpretation bias and fear.

#### 5.4 Discussion

When data from all three experiments were combined, trait anxiety was found to predict fear; in other words, the more trait anxious the child, the more fearful they became of the animals due to information. This finding is in line with what was predicted and with previous research, which has shown that trait anxiety moderates the effect of threat information on fear (Field, 2006b; Field & Price-Evans, 2009). Although a large amount of inconsistency was found amongst Experiments 1, 2 and 3 with regards to whether trait anxiety predicts fear, we can view the current finding with greater confidence because larger sample sizes add precision to the regression coefficients.

Although interpretation bias was found to increase fear following verbal information, it was not found to mediate the relationship between trait anxiety and fear. However, tentative evidence was found indicating that interpretation bias *moderates* the relationship between trait anxiety and fear. In other words, fear is exacerbated by a combination of trait anxiety and interpretation bias, however this effect was only significant when the regression parameters and estimates were not bias-corrected and based on bootstrap sampling and should therefore be taken with caution. Hence, this finding only partially supports predictions and previous research demonstrating that high trait anxious children are inclined to interpret ambiguous stimuli as threatening (Bögels & Zigterman, 2000; Hadwin et al., 1997; Muris, Merckelbach et al., 2000; Muris & van Doorn, 2003; Taghavi et al., 2000; Lester et al., 2010).

Cognitive rehearsal was not found to have a significant relationship with fear (not surprising when considering the results from Experiments 1, 2 and 3) and this finding did not vary as a function of trait anxiety. However, children who experienced more severely negative thoughts about the animals interpreted the information as more threatening than children who had less negative thoughts or indeed positive thoughts about the animals. Although interpretations were measured later, it is possible that the direction of this relationship is the other way i.e. negative interpretation leads to more negative thoughts. This finding makes sense as if children are thinking negative thoughts about the animals: they must have interpreted the information negatively to arrive at their negative thoughts.

Compared to children who interpreted the information as non-threatening, children who interpreted the information as threatening constructed: (1) *more* false-negative memories; (2) *fewer* false-positive memories and; (3) *fewer* more-positive memories. These findings are in line with what was predicted. However, contrary to predictions trait anxiety did not significantly moderate any of these relationships.

It was also predicted that biased memory would mediate the relationship between interpretation bias and fear; this prediction was found to be true for positive memories only. In other words children who showed an interpretation bias for the ambiguous information constructed fewer positive memories of the information leading them to become more fearful of the animals. These findings are in line with Williams (1997) who reported that depressed and non-depressed individuals differ with regards to speed of retrieval of *positive* not negative memories.

Specifically, people suffering from depression have been found to be slower at retrieving positive life events from memory than non-depressed controls; however they are not much quicker than non-depressed controls at retrieving negative events. Whilst the current study is

looking at anxiety and not depression, as mentioned above, it is well documented that anxiety and depression are strongly related conditions in both adult and youth populations (Mineka, et al., 1998; Seligman & Ollendick, 1998). Additionally, it has been argued that anxiety and depression share a variety of cognitive aspects (e.g., Kendall & Watson, 1989).

## **6 General Discussion**

There were three main aims of this thesis: (1) to investigate the presence of cognitive biases (i.e. cognitive rehearsal, interpretation bias and memory bias) as a function of trait anxiety in children; (2) to investigate whether these cognitive biases predict the development of fear in the face of ambiguous information; and (3) to explore whether the cognitive biases (either alone or in combination) can explain the relationship between high levels of trait anxiety and fear, i.e. do the cognitive biases explain the mechanism underlying the relationship between trait anxiety and fear. Each of these aims will be evaluated, followed by a consideration of theoretical and clinical implications of the findings, the limitations of the current work and the implications for future work.

Due to the fact that in all three experiments of this thesis the methods and procedures were identical with respect to interpretation bias and memory bias, the current general discussion will focus on the findings from Chapter 5 (all data) in which data from each experiment were pooled and analysed as one large data set. This strategy was chosen because as mentioned previously, larger samples provide greater statistical power and generate parameter estimates that are more precise and representative of the population (Field, 2009). However, because each experiment's method and procedure differed with respect to the cognitive rehearsal manipulation, the findings for cognitive rehearsal from each experiment will be discussed in turn.

### **6.1 Summary of key findings**

When data from each of the three experiments were pooled, it was found, as predicted, that trait anxiety predicts fear: children who were more trait anxious became more fearful of the animals



due to ambiguous information. Additionally, a threat interpretation bias was found to predict increased fear: children who interpreted the ambiguous information in a more threatening manner became more fearful of the animals as a result. However, contrary to what was predicted, neither interpretation bias nor cognitive rehearsal mediated the relationship between trait anxiety and fear. In other words, according to the present findings, the relationship between trait anxiety and fear cannot be explained by a threat interpretation bias or by the process of negative cognitive rehearsal.

On a more positive note, in line with what was predicted, interpretation bias was found to predict biased memory encoding. Specifically, children who interpreted the ambiguous information in a more threatening manner were found to construct fewer false-positive memories (positive information remembered that was not in fact told) and more false-negative memories (negative information remembered that was not in fact told) of the information. However, contrary to what was predicted, the relationship between interpretation bias and memory was not moderated by trait anxiety; in other words, the relationship between interpretation bias and memory was not more pronounced for children who are more trait anxious than for children who are less trait anxious.

Interestingly, the relationship between interpretation bias and fear was mediated by a memory bias in the form of fewer positive memories. In other words, children who interpreted the information as being more threatening, constructed fewer positive memories of the ambiguous information, and in turn, became more fearful of the animals. As such, biased memory in the form of fewer positive memories can potentially explain the relationship between interpretation bias and fear. Each of these findings will now be discussed in more detail.

## 6.2 Trait Anxiety and Fear

Trait anxiety was found to predict fear<sup>1</sup> resulting from ambiguous information about two novel animals. In other words, the more trait anxious the child, the more fearful they became of the animals due to ambiguous information thus providing support for previous research (Field, 2006b; Field & Price-Evans, 2009), which has shown that trait anxiety moderates the effect of threat information on fear. Given that trait anxiety can lead to changes in fear-related responses, the next important question is how this might occur. What is the mechanism underlying the relationship between trait anxiety and fear?

It was predicted that cognitive rehearsal and the cognitive biases would explain the relationship between trait anxiety and fear: when they hear some ambiguous information highly trait anxious children should interpret it negatively, cognitively rehearse it and remember it as being more threatening than it was originally, which, in turn increases their feelings of fear and anxiety. The findings relating to cognitive rehearsal, interpretation bias and memory bias as possible mediators of the relationship between trait anxiety and fear will now be discussed in turn.

### 6.2.1 *Does Cognitive Rehearsal Explain the relationship between trait anxiety and fear?*

Across the three experiments, cognitive rehearsal was consistently found not to be a significant mediator (or moderator in Experiment 2) of the relationship between trait anxiety and fear, suggesting that cognitive rehearsal does not explain the relationship between trait anxiety and fear. The findings relating to cognitive rehearsal of each experiment will be examined in more detail because it was manipulated in different ways across different experiments.

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<sup>1</sup> When we talk about ‘fear’ we refer to the latent variable which was created by combining data from the fear beliefs questionnaire (FBQ) and the animal avoidance task (NRT). Therefore, this latent variable covers two of Lang’s three fear-response systems: subjective experience (measured by self-report) and avoidance behaviour (measured by the nature reserve task).

Experiment 1 was a naturalistic study and looked at whether high trait-anxious children are more likely than less trait anxious children to engage in cognitive rehearsal subsequent to hearing some ambiguous information regarding a novel animal and being told that they would soon be asked to approach the animal. However, contrary to predictions, it was found that trait anxiety did not significantly affect the extent to which children cognitively rehearse ambiguous information and whether they cognitively rehearsed the information or not made no significant difference to their levels of fear for the animals. Experiment 2 was designed to look at the effect of cognitive rehearsal compared to no cognitive rehearsal by experimentally manipulating whether a child engaged in cognitive rehearsal or distraction. Once again, contrary to predictions, whether children were instructed to cognitively rehearse the ambiguous information or were prevented from doing so (via a distraction task) made no significant difference to their levels of fear towards the animals. Experiment 3 investigated whether the content of thoughts (positive or negative) during cognitive rehearsal would have an effect on fear responding, and whether the effects would vary as a function of trait anxiety. Unfortunately, the results followed the pattern of null results from the previous two experiments and revealed that fear of the animals was not significantly affected by experimentally inducing a negative or positive cognitive rehearsal style and this effect did not vary as a function of trait anxiety.

Unsurprisingly then, given the null results of Experiments 1, 2 and 3, analysis of these data pooled together (in Chapter 5) revealed that cognitive rehearsal did not have a significant relationship with fear and this finding did not vary as a function of trait anxiety. However, what *was* found was that children who experienced more severely negative thoughts about the animals interpreted the information as more threatening than children who had less negative thoughts, or indeed positive thoughts about the animals. This finding is in line with a previous study by

Suarez and Bell-Dolan (2001) who found a strong relationship between self reported child-worry (cognitive rehearsal) and threat interpretation bias. Specifically, they found that children who often engage in cognitive rehearsal in their everyday lives, compared to those who do not, interpreted both ambiguous and threatening situations as more threatening. This suggests that children who engage in cognitive rehearsal are at increased risk for cognitive distortions that may act to increase risk of fear development.

Alternatively, although in the current experiments, interpretations were measured after the cognitive rehearsal task, it is also possible that the direction of this relationship is the other way: i.e., negative interpretation leads to more negative thoughts. This possibility makes sense because if children are thinking negative thoughts about the animals, they must have interpreted the information negatively to arrive at their negative thoughts. Future researchers could try to disambiguate these two explanations by investigating whether: 1) Experimentally manipulated negative cognitive rehearsal can act to change children's original interpretations of ambiguity and; 2) Experimentally manipulating interpretation bias (either positively or negatively) impacts on valence of thoughts during cognitive rehearsal. Such knowledge would shed some light onto the question of causality between interpretation bias and cognitive rehearsal.

The current findings indicate that what children think after hearing ambiguous information has little or even possibly no impact on their feelings of fear towards the animals. These findings are inconsistent with prior research in adults indicating that following a traumatic episode, many individuals engage in negative cognitive rehearsal of the traumatic US (Marks, 1987), which acts to inflate and refine the aversive representation of the US that is evoked by future encounters with the CS causing an increased fear response (Davey, 1992; Jones & Davey, 1990) and is related to a poorer level of general mental health, greater anxiety, and greater physical symptoms

(Segerstrom, Stanton, Alden, & Shortridge, 2003). The current findings are also inconsistent with research from the child-anxiety literature in which the majority of studies have shown a clear relationship between cognitive rehearsal and anxiety in children and adolescents (Muris et al., 2004; Muris et al., 2009; Schwartz & Koenig, 1996). One possible explanation for the non-significant effects of cognitive rehearsal found throughout the current experiments relates to the ambiguous nature of the verbal information used, which may not have been threatening enough for effects to be found. Future researchers could use a mildly negative experience to investigate the effects of cognitive rehearsal on fear in children.

Findings from Experiment 2 are particularly surprising and inconsistent with prior experimental manipulations of cognitive rehearsal and distraction in adults showing that cognitive rehearsal can exacerbate negative mood (Nolen-Hoeksema & Morrow, 1993), negative thinking (Lyubomirsky & Nolen-Hoeksema 1995), negative autobiographical memory recall (Lyubomirsky et al., 1999), poor problem solving skills, impaired motivation and inhibition of on going behaviour (see Lyubomirsky & Tkach, 2004 for a review). The current findings are also inconsistent with the small amount of research that has been done in the child literature. For example, Roelofs et al. (2009) found that children and adolescents (10-17 years) who have a greater tendency to engage in cognitive rehearsal compared to distracting themselves have increases in depression and anxiety scores over time, whereas those who have a greater tendency to engage in distraction compared to cognitive rehearsal have decreases in depression and anxiety symptoms over time. However, Roelofs et al., (2009) used a self-report measure of children's natural coping strategies over time, whereas the current study experimentally manipulated distraction and cognitive rehearsal in a short laboratory study.

Results obtained from Experiment 3 were also surprising, because prior research has shown the valence of thoughts during cognitive rehearsal to be a key factor in determining whether cognitive rehearsal will be constructive or unconstructive. For example, in a large meta-analysis, Mor and Winquist (2002) discovered a strong association between focus on negative self-aspects and increased levels of negative affect, whereas focus on positive self-aspects was related to lower levels of negative affect. Garnefski Rieffe, Jellesma, Terwogt and Kraaij (2007) investigated coping strategies in a sample of non-clinically anxious children and adolescence (9-11 years) and found that a substantial percentage (i.e., 28%) of the variance in fearfulness in children could be explained by the use of cognitive coping strategies. Specifically, cognitive rehearsal, self-blame, and catastrophizing were positively related to fearfulness, whereas positive reappraisal had a strong negative association with fearfulness, suggesting a protective value. In a similar study, Legerstee, Garnefski, Frank, Verhulst and Utens (2010) found that anxiety-disordered youth scored significantly higher on self-blame, cognitive rehearsal, catastrophizing, and acceptance and lower on positive reappraisal, positive refocusing, and refocus on planning than non-clinically anxious children.

As mentioned in Chapter 3, our failure to find any significant effects of cognitive rehearsal is unlikely to be due to the children in the current experiments being too young (8-11 years) to be able to engage in and thus be affected by these sorts of cognitive processes. This is because there is evidence suggesting that children may be capable of engaging in an adult-like worry process as young as 7 or 8 years of age (Vasey & Daleiden, 1994; Bacow et al., 2009), and that this ability to worry is linked to the developing meta-cognitive knowledge that children in this age range possess (Flavell, et al., 1995; Muris, Merckelbach, Meesters et al., 2002). In fact, meta-cognitive knowledge about strategies and tasks is thought to appear after children enter school,

and may be related to the onset of the concrete operational stage, which emerges in children at age 7 (Piaget, 1970).

An alternative explanation for why no significant effects of cognitive rehearsal were found in the current experiments comes from research by Nolen-Hoeksema and Davis (1999) who have indicated that a repetitive style of thinking appears to be a stable individual difference characteristic, which has been hypothesized to be learnt in childhood, either because it was modelled by parents who themselves had a passive coping style (Nolen-Hoeksema, 1991; Nolen-Hoeksema, Mumme, Wolfson, & Guskin, 1995) or because the child failed to learn more active coping strategies for negative affect as a consequence of overcritical, intrusive, and overcontrolling parents (Nolen-Hoeksema et al., 1995). It is feasible then that the children in the current sample had already developed active coping strategies as modelled by their parents, which may have protected them from the effects of cognitively rehearsing possible negative outcomes with the animals. Another possibility, based on the aforementioned research is that to have any effect on fear, the process of cognitive rehearsal needs to be learned over a longer period of time. For example, children in the current experiment cognitively rehearsed for only one minute and this was broken down into four sets of 15 seconds each whereas the adult participants in Nolen-Hoeksema and Morrow (1993) cognitively rehearsed for a solid period of 8 minutes.

It is also possible that processes such as cognitive rehearsal only have negative effects in children who are clinically anxious. The current experiments used a community sample of non-clinically anxious children, who varied in their trait anxiety; however it could be the case that these children were not trait anxious enough and were able to constructively rehearse the ambiguous information. Research has shown that recurrent thinking about negative events can be

functional and result in effective problem solving or successful emotional processing (Harvey, Watkins, Mansell & Shafran, 2004). In Wells's (1995) model, it is the subsequent development of negative rehearsal about negative rehearsal (meta-worry) or (meta-rehearsal), which transforms normal worry (cognitive rehearsal) into problematic varieties. Therefore, it could be the case that non-clinically anxious children are able to use negative cognitive rehearsal as a normal process of problem solving whereas clinically anxious children view the process of negative rehearsal as a threat in itself, thus adding to their feelings of fear and anxiety.

In summary, prior research suggests that recurrent thinking may play a causal role in the maintenance of psychological disorders (e.g., Muris, Roelofs, Meesters, & Boomsma, 2004; Muris, Folke & Kwik, 2009; Schwartz and Koenig, 1996). However this was not found to be the case in the current experiments. Specifically, the current experiments found that: 1) cognitive rehearsal does not mediate the relationship between trait anxiety and fear; 2) the likelihood of cognitively rehearsing ambiguous information did not significantly vary as a function of trait anxiety; and 3) whether children cognitively rehearse ambiguous information or not does not impact on their fear responding. Given the current findings, it might be tempting to conclude that cognitive rehearsal has no bearing on fear development, yet, very few empirical studies have examined cognitive factors specifically in development and maintenance of cognitive rehearsal in children and adolescents (Laugesen, Dugas, & Bukowski, 2003) and relatively little is known about children's interpretations or appraisals of their own cognitive rehearsal processes. Future work is needed to investigate the relationship between cognitive rehearsal and interpretation bias and how this impacts on fear development.

#### 6.2.2 *Does Interpretation Bias Explain the Relationship between Trait Anxiety and Fear?*



It was predicted that children who are more trait-anxious would interpret ambiguous information more negatively than children who are less trait-anxious, which in turn would result in the more trait-anxious children becoming more fearful of the animals. However, although negative interpretation bias was found to increase fear following ambiguous information, which is in line with previous interpretation bias training studies (e.g., Muris, Huijding, et al., 2008), interpretation bias was not found to mediate the relationship between trait anxiety and fear. Specifically, as trait anxiety increased children were more likely to become fearful of the novel animals subsequent to ambiguous information; however, this was not because they were interpreting the information more negatively than children who were less trait-anxious. Therefore, the link between trait anxiety and fear cannot be explained by interpretation bias. This finding is inconsistent with a large body of previous research, which has demonstrated that high trait-anxious children are more likely to interpret ambiguous information as more threatening than less-trait anxious children (see Hadwin & Field, 2010; Lester et al. 2010). Nonetheless, this experiment was novel in that it used novel animals to look at how interpretation biases feed into learning about new ambiguous stimuli and as such cannot be directly compared to previous studies.

Nevertheless, although children who were high trait anxious were not found to be more likely to negatively interpret ambiguous information, tentative evidence was found indicating that interpretation bias *moderates* the relationship between trait anxiety and fear. In other words, fear is exacerbated by a combination of trait anxiety and interpretation bias. However, this effect was only significant when the regression parameters and estimates were not bias-corrected and based on bootstrap sampling and should therefore be treated as speculative. Hence, it remains unclear as to why high trait-anxious children become more fearful of novel animals than low trait-

anxious children after hearing some ambiguous information about them. Nonetheless, the current research tentatively suggests that interpretation bias may be important in strengthening the relationship between trait anxiety and fear.

### **6.3 Interpretation bias and Memory**

#### *6.3.1 Does Interpretation Bias Predict Memory Bias and is this Relationship moderated by Trait Anxiety?*

Results revealed that a threat interpretation bias does indeed impact on memory of ambiguous information. Specifically, compared to children who interpreted the information as non-threatening, children who interpreted the information as threatening constructed more negative and less positive memories. These findings are in line with what was predicted and also with models of biased information processing (*see* Muris & Field, 2008), which suggest that the cognitive biases are unlikely to operate in isolation, and that a bias at one stage of information processing (i.e. interpretation) is likely to impact on later stages (i.e. memory encoding). Thus, when required to retrieve the information from memory, a more threatening recollection of the original information is recalled. However, contrary to predictions and Muris and Field's (2008) model, the relationship between interpretation bias and memory did not vary significantly as a function of trait anxiety. This finding is inconsistent with a very recent investigation by Visu-Petra, Tincas, Cheie and Benga (2010) who found that compared to low trait-anxious children high trait-anxious children were slower and less accurate at detecting and remembering the location of happy faces and more accurate at remembering the location of angry faces. This finding suggests that a bias towards the processing and encoding of threatening stimuli and a bias away from the processing and encoding of positive environmental information and stimuli *is* characteristic of high-trait anxious children. Possible reasons for such inconsistencies with past research are discussed in Section 6.6.1.

### 6.3.2 *Does Memory bias Mediate the Relationship between Interpretation Bias and Fear?*

As we have just seen above, a threat interpretation bias predicted more false-negative and less false-positive memories of the ambiguous information but how does this relationship impact on fear? It was predicted that a threat interpretation bias would lead children to construct more negative memories and less positive memories of the information, which would in turn lead to an increase in fear of the animals. This prediction was found to be correct but for *false positive* memories only. In other words, although children who interpreted the information as more threatening constructed more false-negative *and* less false-positive memories of the information, it was *only* the lack of false-positive memories that resulted in them becoming more fearful of the animals.

This finding relates to previous research in the depression literature. For example, Williams (1997) found that depressed and non-depressed individuals differ with regards to speed of retrieval of *positive*, not negative memories. Specifically, people suffering from depression were slower at retrieving positive life events from memory than non-depressed controls; however, they were not much faster than non-depressed controls at retrieving negative events. This finding suggests that it is not so much the presence of negative memories that increases an individual's risk for depression but it is the *lack* of positive memories that is important. Whilst the current study is looking at anxiety and not depression, extensive research has shown that there is a large overlap in the symptoms of anxiety and depression in both adult and youth populations (Clark & Watson, 1991; Mineka, Watson, & Clark, 1998; Seligman & Ollendick, 1998).

Moser, Huppert, Duval and Simons (2008) have attempted to account for the differential processing of both negative and positive information in high trait anxious participants by proposing the existence of a double-edged bias. On one hand, a negative bias would be revealed

by a tendency of high-trait anxious individuals to preferentially process threatening information; on the other hand, the lack of a positive bias would deprive the same high trait anxious individuals of the preferential processing of positive social stimuli (and the protective bias away from negative information) found in normal controls.

#### **6.4 General Implications**

In accordance with theories of anxiety (e.g., Grey, 1987) and experimental research (e.g. Field, 2006b; Field & Price-Evans, 2009), the results from the current experiments collectively support the conclusion that high trait-anxious children are at an increased risk of developing fear after exposure to ambiguous information. However, although clinical and experimental theories assume that cognitive biases such as interpretation bias and memory bias represent a causal substrate that operates to influence cognitive representation in such a way as to directly mediate anxiety vulnerability (see Beck & Clark, 1997, for a review; Williams et al., 1997), this was not found to be the case in the current experiments. Although both interpretation bias and memory bias significantly predicted increased fear due to ambiguous information, increases in trait anxiety were not found to be significantly more likely to predict information processing biases to threat. However, tentative evidence was found that trait anxiety exacerbates the relationship between interpretation bias and fear.

The findings that (a) a threat interpretation bias predicts the construction of more false-negative and less false-positive memories of ambiguous information, and (b) that construction of fewer false-positive memories mediates the relationship between threat interpretation bias and fear are in line with models of biased information processing (e.g., Muris & Field, 2008), which suggest that the cognitive biases are unlikely to operate in isolation, and that a bias at one stage of information processing (i.e., interpretation) is likely to impact on later stages (i.e., memory

encoding and retrieval). However, contrary to Muris and Field's (2008) model, the relationship between interpretation bias and memory did not vary significantly as a function of trait anxiety: relationship between interpretation bias and memory bias was not moderated by trait anxiety.

Given there is currently only a handful of studies that have investigated memory biases in highly trait-anxious children and the fact that what has been done has provided mixed results (see Muris & Field, 2008, for a review), the lack of evidence found in support of high trait anxiety predicting memory bias in the current experiments is not hugely surprising. Memory bias has in general, been linked more with depression than with anxiety (Williams et al., 1997); thus it may be that the associations found between anxiety disorders and memory biases in some studies are due to concurrent depression symptoms. Nevertheless, the finding that high levels of trait-anxiety does not predict a threat interpretation bias is surprising, especially when considering the large body of research demonstrating that high trait-anxious children *do* show a greater tendency for interpreting ambiguous stimuli as threatening than less trait-anxious children (Bögels & Zigterman, 2000; Hadwin et al., 1997; Lester, et al., 2010; Muris, Merckelbach et al., 2000; Muris and van Doorn, 2003; Taghavi et al., 2000). Some possible reasons for these inconsistencies will now be discussed.

#### 6.4.1 *Why was Trait-anxiety not Predictive of Information Processing Biases?*

One possible reason why trait anxiety did not predict any of the cognitive biases throughout the current experiments (with the exception of Experiment 2, in which trait anxiety moderated the relationship between threat interpretation bias and more-negative memories) is that the current sample of children were unusually low trait-anxious and therefore, even the most trait-anxious of the children were not highly trait-anxious enough for any effects between trait-anxiety and the cognitive biases to be found. However, when inspecting the trait anxiety scores of the current

sample of children, this explanation seems unlikely. For example, the distribution of scores in the current sample was highly comparable to that of a large ( $N = 1554$ ) non-clinical sample of children aged 8-11 years reported by Spielberger (1973). Specifically, in the current sample, the lower quartile = 30, median = 36 and upper quartile = 41.5 and in the sample from Spielberger (1973), the lower quartile = 32, the median score = 37 and the upper quartile = 41.

Another possible reason why trait anxiety did not predict cognitive bias in the current research is that perhaps the effects of anxiety on cognitive biases are only present in clinical samples. For example, the current study used a community sample of non-clinical children but it is possible that cognitive biases are specific to clinically diagnosed anxiety and not to anxiety as a personality trait. There could be something different about clinically diagnosed anxiety that causes these effects to only be found in clinical samples. Previous research reporting high trait-anxiety to be a significant predictor of interpretation bias and memory bias in non-clinical child samples suggests that this explanation is also unlikely (e.g., Bell-Dolan, 1995; Bögels et al., 2003; Chorpita et al. 1996; Daleiden, 1998; Dineen and Hadwin, 2004; Hadwin et al., 1997; Muris, Kindt et al., 2000; Reid et al., 2006; Visu-Petra et al., 2010).

It is worth considering that the lack of any significant relationships between trait anxiety and the cognitive biases is a result of measurement issues. For example, the current study used the STAIC as a measure of child trait anxiety. However, looking at Tables 6.1 and 6.2, it appears that none of the previous studies reporting a significant relationship between trait anxiety and either interpretation bias or memory bias have used the STAIC as a single measure of trait anxiety. Although the STAIC has acceptable to good psychometric properties and provides useful information on childhood anxiety symptoms (Muris, Merckelbach, Ollendick, King & Bogie 2002; Papay, Costello, Hedl & Spielberger 1975), its main limitation is that it is not linked

to the anxiety categories that are listed in the Diagnostic and Statistical Manual of Mental Disorders (DSM–IV; American Psychiatric Association (APA), 1994; see Stallings & March, 1995 for a discussion), it is unidimensional and hence does not tap various symptom domains. As a result, the clinical utility of the STAIC has often been questioned (see Muris, Merckelbach, Ollendick et al., 2002). Therefore, it is possible that the current experiments did not find a significant relationship between trait anxiety and cognitive bias because the STAIC was not measuring the right thing (i.e., it did not tap into the right aspects of trait anxiety). It has been documented that the more recently developed instruments for measuring trait anxiety such as the Screen for Child Anxiety Related Emotional Disorders (SCARED), the Multidimensional Anxiety Scale for Children (MASC) and the Spence Children's Anxiety Scale (SCAS), are more closely connected to current diagnostic systems such as the DSM-IV (American Psychiatric Association (APA), 1994) and thus facilitate communication about anxiety problems in children and adolescents (Chorpita, Yim, et al., 2000). As such it may have been preferable to use one of the more recently developed questionnaires over the STAIC. On the other hand, many of these studies listed in Tables 6.1 and 6.2 that have reported a significant relationship between trait anxiety and cognitive biases have used the Revised Children's Manifest Anxiety Scale (RCMAS) which has been found to be strongly allied with the STAIC; both questionnaires have been found to tap general levels of anxiety (Muris, Merckelbach, Ollendick et al., 2002), thus providing support for use of the STAIC in the current context.

*Table 6.1: Overview of published experimental studies examining the relationship between anxiety and interpretation bias in children.*

Study	Measure(s) of Anxiety	Clinical Sample?	Interpretation Bias Measure	Anxiety level predictive of Interpretation Bias?
Bell-Dolan (1995)	RCMAS	No	Videotaped peer interaction vignettes.	Yes
Barrett et al. (1996)	ADIS-C	Yes	Vignettes of ambiguous situations.	Yes
Chorpita et al. (1996)		No		Yes
Hadwin et al. (1997)	RCMAS	No	Ambiguous homophones	Yes
Dalgleish et al. (1997)	RCMAS	Yes	Ambiguous social scenarios	Yes
Bögels and Zigterman (2000)	DISC	Yes	Ambiguous stories	Yes
Taghavi et al. (2000)	RCMAS	Yes	Ambiguous homophones	Yes
Muris, et al.(2000a)	SCARED, STAIC and DISC	No	Ambiguous stories	Yes
Muris, et al. (2000b)	SASC-R and SCARED	Yes	Ambiguous stories of social situations	Yes
Suarez & Bell-Dolan (2001)	PSWQ-C	No	Ambiguous and threatening situations.	Yes
Bögels et al. (2003)	SCARED-R	No	Vignettes of social situations	Yes
Dineen & Hadwin (2004)	RCMAS	No	Ambiguous social scenarios	Yes
Creswell et al. (2005)	RCMAS and ADIS-CP	Yes	Ambiguous scenarios	Yes
Waters et al. (2008)	ADIS-C and MASC	Yes	Ambiguous stories	Yes
Micco & Ehrenreich (2008)	ADIS-CP and RCADS.	Yes	Ambiguous stories	Yes
Reid et al. (2006)	RCMAS	No	Ambiguous situations	Yes, but also found in depressed and aggressive children.

Note: ADIS-CP = Anxiety Disorders Interview Schedule for DSM-IV Child and Parent versions; ADIS-C = Anxiety Disorders Interview Schedule for Children; RCMAS = the Revised Children's Manifest Anxiety Scale; DISC = National Institute of Mental Health Diagnostic Interview Schedule for Children; SCARED = The Screen for Child Anxiety Related Emotional Disorders; MASC = The Multidimensional Anxiety Scale for Children; RCADS = Revised Child Depression and Anxiety Scale; PSWQ-C = Penn-State Worry Questionnaire For Children; SASC-R = Social Anxiety Scale for Children-Revised.



Table 6.2: Overview of published experimental studies examining the relationship between anxiety and memory bias in children.

Study	Measure(s) of Anxiety	Age (years)	Clinical Sample?	Memory Bias Measure	Anxiety level predictive of Memory Bias?
Daleiden (1998)	STAIC, CASI,	11-14	No	Positive negative and neutral words: 1) Word fragment completion task to measure perceptual memory processing. 2) Semantic cue task to index conceptual memory processing.	<b>Yes.</b> Only on the conceptual memory task, suggesting that memory bias occurs only in tasks that require processing of the meaning of stimuli.
Moradi, et al. (2000)	DSM-IV - criteria for a primary diagnosis of PTSD.	9-17	Yes (PTSD)	Free-recall task of negative, positive and neutral words followed by a recognition test.	<b>Yes, but only weak evidence.</b> Free recall task – no difference between PTSD and control youths with regard to negative words, but control participants recalled significantly more neutral and positive words. Recognition test - no significant group differences.
Dalgleish, et al. (2003)	RCMAS	7-18	Yes (PTSD or GAD)	Free-recall test using the same methodology as Moradi, et al. (2000)	<b>No.</b> Anxiety disordered children did not differ to controls.
Watts and Weems (2006)	RCADS	9-17	No	Examined the relationship between self-reported and parent-reported anxiety and memory bias.	<b>Yes but the effect was modest.</b> Memory bias score correlated significantly with child- and parent- reported anxiety scores, $r = .23$ and $r = .26$ , respectively.
Visu-Petra et al. (2010)	SCAS	4-7	No	Angry, happy and neutral facial expressions in a modified version of the odd one out task	<b>Yes.</b> Between group differences- Compared to low anxious children, high anxious children were slower and less accurate in detecting and updating happy faces, but more accurate in responses to angry faces. Within group differences- Low anxious children were less accurate in response to angry (relative to happy and neutral) faces, while high anxious children were less accurate in response to happy (relative to neutral) facial expressions.

DSM-IV = Diagnostic and Statistical Manual of Mental Disorders, 4th edition, criteria for a primary diagnosis of PTSD. RCADS = The Revised Child Anxiety and Depression scales. RCMAS = Revised Children's Manifest Anxiety Scale. STAIC = the State-Trait Anxiety Inventory for Children. CASI = Children's Anxiety Sensitivity Inventory. SPAS = Spence Preschool Anxiety Scale.

Another possible reason for the non-significant relationships found between trait anxiety and cognitive biases throughout the current experiments is that trait anxiety was analysed along a

continuous, dimensional scale ranging from high to low trait anxious and it could be the case that a more categorical analysis would have been more appropriate. For example, perhaps there is a cut off point somewhere along the trait anxiety scale and only the children who score above a certain threshold are highly trait-anxious enough for effects between trait anxiety and cognitive bias to be found. For example, Daleiden (1998) found trait anxiety to be predictive of memory bias in a group of high- and low- trait anxious children using the STAIC, but this study used a cut-off point to distinguish high from low trait anxious children. Specifically, trait anxiety scores of 45 and 55 were used as cut-off points to identify groups of low-anxious and high-anxious children respectively. Indeed it is frequently contended that categorical diagnoses are favored for professional communication, clinical decision-making and distinguishing between individuals with and without a mental disorder (Kamphuis & Noordhof, 2009). Nevertheless, it has been noted that The DSM-V will likely place more emphasis on dimensional rather than categorical representation of mental disorders, as dimensional systems have the psychometric advantage that more statistical power is preserved for identifying differences in subsequent analyses (as argued by Frances, 1993; Widiger, 1992).

## **6.5 Clinical Implications**

The current findings can suggest some ways in which the development of childhood fear may be reversed or possibly even prevented. For example, the more we know about how fears develop, the better equipped we will become at understanding how they can be reduced or even prevented. First, the findings confirm that children who show a disproportionate tendency to interpret ambiguous cues as threatening are more likely to become fearful of new and potentially threatening stimuli in their environment, both directly and indirectly through reduction in positively biased memory. Therefore, it is possible that training children to interpret information

more positively may reduce their risk of developing fear. Indeed, previous research in adults has consistently shown that inducing a positive interpretation bias reduces state anxiety (e.g., Mathews & Mackintosh, 2000; Wilson et al., 2006; Yiend et al., 2005). Despite the current lack of such experiments in the child literature, so far findings indicate that positive interpretation bias training also reduces state anxiety in children (e.g., Muris, Huijding et al., 2008; Vassilopoulos et al., 2009) but not consistently so; for example, in a study by Muris, Huijding et al., (2009) experimental training was successful in influencing children's interpretation biases in the predicted direction. However, high-anxious children were not significantly more affected by the experimental manipulation than low-anxious children. Moreover, the change in interpretation bias was not significantly associated with change in avoidance tendencies. This research is still in its infancy and it is clear that more research is needed to discover the optimal experimental conditions for training a positive interpretation bias and reducing anxiety in children.

The current findings also confirm for therapists treating fears and phobias that a lack of positively biased memories poses a risk factor for fear development. Thus training children to have a positive memory bias may act to prevent fear development in the face of ambiguous information. Indeed in Experiment 1 it was found that fear beliefs decreased in children who remembered the ambiguous information as being more positive than it in fact was. However, because positively biased memory mediated the relationship between interpretation bias and fear, it is possible that treatment that trains a positive interpretation bias will in turn increase more positively biased memories and thus reduce fear. Nevertheless, it may be the case that both positive interpretation bias training and positive memory bias training together would be the optimal treatment for fear reduction in children, especially if, for example, treatment of fears is

found to be more effective when specifically aimed at each stage of biased information processing through which the fear is acquired or maintained.

## **6.6 Limitations and Future Work**

One important limitation to consider is that there were various inconsistencies in findings across the three experiments. For example, when the data from each experiment were pooled and analyzed as one data set, trait anxiety was found to predict fear. However, with regard to each experiment separately, the relationship between trait anxiety and fear was found only to be significant in Experiment 2. As mentioned previously, this inconsistency could be partly be due to the fact that each individual experiment had a relatively small sample size and so would have had low power to detect the effects; also, estimates of population statistics tend to fluctuate more in smaller samples than larger ones (Field, 2009).

It could also be the case that trait anxiety predicted fear in Experiment 2 but not in the other two experiments because Experiment 2 consisted of a particularly high trait-anxious sample, or alternatively, Experiments 1 and 3 consisted of particularly low trait anxious samples. However, looking at Table 6.3, the distributions of scores across the three experiments were highly comparable suggesting that this explanation is unlikely. Table 6.3 also shows that the distribution of trait anxiety scores in the current Experiments were highly similar to the distribution of trait anxiety scores from Spielberger et al. (1973), who collected normative data for the STAIC from a large sample ( $N = 1554$ ) of non-clinical children aged 8-11 years, indicating that the children in the current samples were not abnormally high or low trait anxious.

As discussed above, it is possible that the STAIC was not the most appropriate measure of trait anxiety due to the fact that it is not as closely related to current diagnostic systems such as DSM-

IV as the more recently developed trait anxiety measures such as the SCARED, MASC and the SCAC, which better facilitate communication about anxiety problems in youths (Chorpita, Yim, et al., 2000). Future work is needed to replicate the current experiments using one of the newly developed trait anxiety measures to investigate this possibility.

Table 6.3: Distribution of trait anxiety scores in Experiments 1,2 and 3 and from data collected by Spielberg et al. (1973)

<b>Experiment</b>	<b>Lower Quartile</b>	<b>Median</b>	<b>Upper Quartile</b>
1	32.0	38.0	42.0
2	30.0	35.5	39.3
3	30.0	36.0	42.0
Spielberger et al. (1973)	32.0	37.0	41.0

An obvious limitation with Experiments 1 and 2 was the touch box task. The touch box used in these experiments failed to produce analysable data. Nearly all children were willing to put their fingers into all the holes along the tube leading into the animal boxes, thus producing a ceiling effect. Although in Experiment 3 this task was modified to resemble tasks used successfully in previous experiments (e.g. Field & Lawson, 2003), it remains unknown how the variables in Experiments 1 and 2 affected behavioural avoidance of the animals. Additionally, comparisons cannot be made between the first two experiments and Experiment 3 regarding this task.

An important finding of the current research is that a threat interpretation bias increases a child's risk of becoming fearful, both directly and indirectly via a reduction in the construction of positive memories. Investigations into positive interpretation bias training in children are still in their infancy and results have been inconsistent (e.g. Muris, Huijding et al., 2008; Muris, Huijding et al., 2009) suggesting that further work is needed to refine the methods of positive interpretation bias training in youth populations. Additionally, future research is needed to investigate whether successful positive interpretation bias training also impacts on memory bias

(i.e., in the current research, a threat interpretation bias was found to predict fewer positive memories. As such, it is possible that a trained positive interpretation bias would increase the number of positive memories and decrease the number of negative memories constructed.

Future research into positive memory training is also needed. For instance, future experiments could look at whether positive memories can be trained in children via techniques such as modelling and positive reinforcement and if so, what is the impact on fear? Further research could investigate whether interpretation bias training alone is enough to increase positive memory construction and reduce fear in children, or whether positive interpretation bias training and positive memory bias training have independent and additive effects on fear reduction which would suggest that a combination of both training procedures would be the optimal method of fear reduction. Such information would inform treatment programmes targeting the detrimental social and academic consequences associated with childhood anxiety, given the causal role that cognitive biases are likely to play in the etiology and maintenance of such unwanted outcomes (Vasey & MacLeod, 2001). However, the current experiments used a sample of non-clinical children and therefore, cannot be used to draw conclusions about children with anxiety-related disorders. Future experiments are needed to investigate these effects in a sample of clinically anxious children.

As mentioned earlier with regard to cognitive rehearsal, it is possible that to have any effect on fear, the process of cognitive rehearsal needs to be learned over a longer period of time. For example, children in the current experiments cognitively rehearsed for only one minute and this was broken down into four sets of 15 seconds each, whereas adult participants in Nolen-Hoeksema and Morrow (1993) cognitively rehearsed for a solid period of 8 minutes. Future experiments with children could extend the length of the cognitive rehearsal task to a period of 8

minutes or perhaps look at the effect of cognitive rehearsal manipulation over a period of multiple sessions. Future work also needs to look at cognitive rehearsal longitudinally, which would provide a better understanding of the natural development of cognitive rehearsal in children over time. Finally, children in the current experiments cognitively rehearsed ambiguous information, but it is possible that for cognitive rehearsal to significantly affect fear it has to be about something traumatic. As such, future research should investigate the effects of cognitive rehearsal in the face of a mildly threatening experience.

## 6.7 Final Summary

The current research investigated the link between cognitive bias (cognitive rehearsal, interpretation bias and memory bias) and fear in a sample of high and low trait anxious children with the use of ambiguous information about two novel animals. Results revealed that while trait anxiety significantly predicted fear, none of the cognitive biases were able to explain the mechanism underling the relationship between trait anxiety and fear. However, tentative evidence suggests that interpretation bias exacerbates the relationship between trait anxiety and fear. Unfortunately, it was found that whether children rehearsed the ambiguous information or not had no significant impact on their fear levels, nor did the valence of their thoughts. However, negative cognitive rehearsal was found to predict threat interpretation bias, suggesting that a repetitive negative thinking style can lead to cognitive distortions, which pose a risk of fear development. Significant relationships were found between a threat interpretation bias and a more-negative and less-positive memory bias and interestingly it was the *lack* of false-positive memories that lead children to become more fearful of the animals.

The current results carry some implications for treatment programmes. Positive interpretation and memory bias training may act to decrease or even help to prevent fear development in

children. Research into the development of the cognitive biases is still currently lacking, especially with regard to memory bias and cognitive rehearsal. Much more work is needed, for example with younger age groups, and it will be important to investigate the longitudinal course of the cognitive biases to shed more light on how these biases develop.

## **7 Critical Appraisal of the Research Undertaken**

After taking time to reflect on the research undertaken in this thesis, I have gathered some thoughts on the overall theoretical conceptualization and methodological operationalization of the key variables within the three studies described. This section will discuss these thoughts and aims to give rise to suggestions for a possible new sequence of studies to investigate the most important theoretical propositions.

### **7.1 Theoretical Conceptualization**

The aim of this thesis was to investigate whether memory bias, cognitive rehearsal and interpretation bias could explain the relationship between trait anxiety and fear. Five main hypotheses, based on theory and past research, ran through the experimental chapters, specifically: (1) Replicating Field (2006b), children who are more trait anxious, relative to children who are less trait anxious, would become more fearful of a novel animal after hearing some ambiguous information about it. (2) Because children who are more trait anxious have been found to disambiguate ambiguous information as more threatening (Field, 2006b), the relationship between trait anxiety and fear should be mediated by interpretation bias. In other words, children who are more trait anxious would interpret the information as being more threatening and therefore become more fearful of the animals. (3) The relationship between trait anxiety and fear should also be mediated by how children think about the information: children who are more trait anxious are predicted to cognitively rehearse the ambiguous information and



in doing so derive a more negative meaning from it, leading them to become more fearful of the animals. (4) Children who disambiguate the verbal information in a threatening way (interpretation bias) would subsequently encode the information more negatively into memory and therefore show a memory bias for the information and this relationship would be moderated by trait anxiety. In other words, the relationship between interpretation and memory would be stronger for highly trait anxious children than for less trait anxious children. (5) Finally it is predicted that memory will mediate the relationship between interpretation bias and fear: children who interpret the information as being more threatening would also encode the information as being more threatening into memory which would lead to them becoming more fearful of the animals.

These hypotheses have each looked at how small subsets of the cognitive biases might interact and impact on the processing of ambiguous information, however, there has as yet been no consideration of how they might interact in one inclusive theoretical framework. There are in fact a number of forms in which such a model could take. Based on the hypotheses of this thesis, one possible model might predict that children who are more trait anxious should interpret potentially threatening information more negatively than a child who is less trait anxious, and subsequently engage in negative cognitive rehearsal of the information and thus encode the information into memory as being more negative than it was originally, resulting in an increase in feelings of fear.

This model appears to make sense, as when considering the order of information processing (*see* Daleiden and Vasey's 1997 model), it seems sensible that for information to be rehearsed and encoded into memory it first needs to have been interpreted. However, it could also be the case that engaging in cognitive rehearsal helps children to determine how new information is

interpreted and encoded and as such, it could be the case that cognitive rehearsal occurs prior to interpretation. Additionally, the experiments in this thesis have not considered or looked at the effect of past memory on interpretation. Muris and Field (2008) suggest that in anxiety, recall of memories congruent with the cause of one's anxiety ultimately results in a biased interpretation of ambiguous situations. This suggests that when learning about new potentially threatening stimuli, memories of past anxiety provoking situations may bias how new information is processed, suggesting that memory can also impact on interpretation bias.

Another potential problem with the proposed model, and also the interpretation of the results throughout this thesis is that 'fear' is assumed to be the outcome of the interaction between the cognitive biases. For example, one of the main findings of this thesis was that a threat interpretation bias led to fewer false positive memories, which in turn led to increased fear. However, because interpretation bias and memory were not manipulated in the current set of experiments causality cannot be inferred, and as such, it is also possible that fear comes into play at a much earlier stage in the model. For example, it is possible that 'fear' elicited by a threat interpretation bias, brings about negative cognitive rehearsal and less positively biased memory encoding. Recent interpretation bias training studies have found that experimentally inducing either a negative or positive interpretation bias in children affects state anxiety; specifically, successful positive interpretation bias training was found to reduce state anxiety, whereas negative interpretation bias increased state anxiety (Muris et al., 2008) this research suggests that a threat interpretation bias can indeed increase fear. Nonetheless, research has also shown that manipulating interpretive biases can result in corresponding changes in memory biases (Tran, Hertel, and Joormann, 2011).

It would seem then, that there are multiple possible forms of which such an inclusive model

could take. The causal relationships between these variables are difficult to unpick and it would take many experiments before reaching any sort of sound conclusion, one method of conducting such experiments would be to manipulate one variable and measure how it affects the other variable(s). For example, to investigate whether the finding of the current thesis that; ‘memory mediates the relationship between interpretation bias and fear’ is actually better explained as; ‘fear mediates the relationship between interpretation bias and memory; three proposed studies are briefly outlined:

Study 1 could look at the effect of experimentally inducing a threat interpretation bias via interpretation bias training (eg., Muris et al., 2008; Muris et al., 2009) versus a control condition in which no interpretation bias training is received, on memory and fear of ambiguous information, this would give an indication of whether interpretation bias causally effects memory and fear. As mentioned previously, Tran et al. (2011) have shown that induced interpretation bias does result in a corresponding memory bias for ambiguous information.

Study 2 could look at the effect of experimentally inducing a memory bias vs. a control on fear. This study would indicate whether memory causally affects fear. After taking a baseline measure of fear, memory could be manipulated by providing children with a short vignette containing a mixture of positive and negative information. Children would then be primed to recall as much of the negative information that they could to induce a memory bias. There would then need to be a manipulation check of whether memory bias training had been successful before measuring fear in both the memory bias and control group.

Study 3 could then look at whether fear is able to causally affect memory by using a fear induction task. There would be ethical issues attached to a fear induction task and it would have

to involve only a very mild threat. Children could be provided with the same vignette as in Study 2 (containing both threatening and positive information) followed by the fear induction or no fear induction (depending on which group the child was in) a manipulation check would then be required to test whether the fear induction had successfully induced fear followed by a memory test of the information.

Of course, the above-proposed studies would only shed light onto a small part of the model and a major limitation is that they do not take cognitive rehearsal into account. Unfortunately, the lack of significant relationships found between cognitive rehearsal and the other variables in this thesis, makes it difficult to predict where (and even if) cognitive rehearsal fits into the model. It is possible that the lack of significant effects of cognitive rehearsal found here is due to the fact that children of this age group are not yet able to engage in cognitive rehearsal. However, a more likely explanation relates to measurement issues, which will be discussed below.

## **7.2 Methodological Operationalisation of Key Variables**

The experiments in this thesis used a combination of reliable measures that have been used in previous experiments (e.g., the Fear Beliefs Questionnaire, Nature Reserve task, the touch box task and the STAI-C) and novel measures which were developed specifically for the purpose of the current experiments (e.g., the interpretation bias and memory questionnaire and the cognitive rehearsal tasks). When using novel methods, there is always an issue of whether they are both reliable and valid. In the three experiments described in this thesis, reliability and validity are particularly in question with regard to the cognitive rehearsal tasks.

So far only a very limited amount of research has been conducted on cognitive rehearsal in the child anxiety literature, and as a result it is unknown whether cognitive rehearsal exists in

children. For example, it is unclear whether children possess the cognitive abilities to cognitively rehearse and if so, whether they cognitively rehearse in the same way as adults. An additional consequence of the lack of research in this area is that there is as yet no precedent for how to measure cognitive rehearsal in children, and as such, the methods used in this thesis were novel. To recap, cognitive rehearsal was measured subsequent to providing children with some ambiguous information regarding a novel animal by asking them to verbalize what they had been thinking at a total of 4 x 15 second intervals. At each 15-second interval children tended to respond with a single thought rather than multiple thoughts, which was coded for severity ranging from severe negative to severe positive and whether the thought was an animal or non-animal thought. If at any of the four time intervals a child did have more than one thought, all thoughts were taken into account and an overall severity score was given. Therefore, each child ended up with four severity scores in total and a mean severity score was then calculated for each child by subtracting mean animal-thought severity score from mean non-animal thought severity score.

One concern with this method of measuring cognitive rehearsal is whether what the children were doing in the experiments was in fact cognitive rehearsal, or whether they were simply having independent thoughts and not rehearsing the same thought(s). It is difficult to know what cognitive processes the children were engaging in during the 15-second intervals between being asked to verbalise their thoughts. On the one hand, it could be argued that asking children what they had been thinking is a good way to sample thoughts and get an idea of what thinking processes they were engaging in, however, on the other hand, asking children what they were thinking every 15 seconds may have disrupted any cognitive rehearsal that was taking place. Perhaps it would have been better and less disruptive to ask the children to think about the

information and approach task solidly for a couple of minutes and then ask them what sorts of thoughts they had been having during that time, and also ask them about the style of thinking they were engaging in i.e. whether they were rehearsing the same thoughts or having independent or random thoughts. However, this method would rely on the children being able to understand, articulate and remember the thoughts they were having and the style of thinking they were engaging in, which may be too challenging for young children of this age group (8-11 years).

Another potential problem with regard to the cognitive rehearsal measure refers to the method of scoring the children's thoughts. For example, during the cognitive rehearsal task thoughts were scored for how severe they were (ranging from severely negative to severely positive on a five point scale) rather than whether the child was rehearsing the same thought. It might have made more sense to score thoughts for whether they were repetitive as well as how severe they were. For example, a child may have had some severe negative thoughts but they may not have all been of a similar nature; the child may not have been thinking in a repetitive style and as such, it could be argued that instead of looking at whether children who are more trait anxious naturally cognitively rehearse ambiguous information, the experiments were looking at whether children who are more trait anxious naturally have threat thoughts about ambiguous information.

Cognitive rehearsal is a difficult construct to measure, as it is difficult to get at what people are really thinking. Suarez and Bell-Dolan (2001) used a questionnaire to measure how often children engage in cognitive rehearsal in their every day lives. The benefits of measuring cognitive rehearsal in this way are that cognitive rehearsal happens over a long period of time and thus trying to capture whether a child tends to naturally cognitively rehearse in a short experiment is very difficult. However, it is uncertain whether children of this age group would be

able to give an accurate appraisal of the thought processes that they usually engage in, also some or all children aged 8 years may not understand what cognitive rehearsal is. Additionally, whilst using a questionnaire may give an indication of whether children who are more trait anxious naturally cognitively rehearse, Experiments 2 and 3 looked at causal relationships between cognitive rehearsal and fear and thus it was necessary to experimentally manipulate cognitive rehearsal.

It could be the case that each experiment in this thesis looked at too many variables. Perhaps interpretation bias and memory should have been investigated together in one set of experiments since they seem to impact on each other, and cognitive rehearsal should have been looked at in a separate set of experiments, and then at the end all of the cognitive biases could have been looked at together. One reason for doing this is that perhaps when looking at cognitive rehearsal it is necessary to use a mildly threatening experience rather than ambiguous information, whereas ambiguous information is required when looking at interpretation bias and memory bias.

It is also possible that the process of cognitive rehearsal is not problematic; research has shown that recurrent thinking about negative events can be functional and result in effective problem solving or successful emotional processing (Harvey, Watkins, Mansell & Shafran, 2004). In Wells's (1995) model, it is the subsequent development of negative rehearsal about negative rehearsal (meta-worry) or (meta-rehearsal), which transforms normal worry (cognitive rehearsal) into problematic varieties. Therefore, it could be the case that most children are able to use negative cognitive rehearsal as a normal process of problem solving and it is only when children view the process of negative rehearsal as a threat in itself, thus adding to their feelings of fear and anxiety that it becomes a problem. As such, perhaps meta-worry should have been measured in the current experiments rather than cognitive rehearsal.

Due to the limited research available on cognitive rehearsal in children, it may have been more appropriate to take a step back and look at whether children of the age group tested possess the cognitive abilities to engage in cognitive rehearsal. One possible method of doing this would be to look longitudinally at whether cognitive rehearsal correlates with cognitive development. In other words, is there a point in development where children are suddenly able to engage in cognitive rehearsal? Muris, Mayer, Vermeulen, and Hiemstra (2007b) found that children's performance on conservation tasks and a Theory- of-Mind test were significant predictors of anxious interpretations and emotional reasoning scores, which suggests that these phenomena are influenced by cognitive development. In the worry literature, a recent study has found that age does not affect amount of worry, but it does affect worry elaboration, suggesting with increasing age children are able to catastrophize more (Grist & Field, submitted). On the other hand, other researchers have pointed out that certain cognitive distortions (e.g., attention bias) begin as normal developmental phenomena over which children gradually gain control as they become older. A failure to control or inhibit such biases would be indicative of children and adolescents with anxiety problems (Kindt & Brosschot, 1999; Kindt et al., 1997; Kindt, van den Hout, de Jong, & Hoekzema, 2000).

In summary, taking time to reflect over the research conducted in this thesis has been very valuable in helping me to gain a better understanding of the research process and how important it is to take time to think and plan thoroughly before conducting the next experiment. If I were to conduct this research again, I would carry out some pilot studies before conducting each experiment and I would have taken more time between conducting Experiment 1 and Experiment 2. Due to the fact that this M.Phil was unfunded, I felt financial pressure to complete the data collection in as short a time period as possible. However, I realise now that as a consequence of



this, the design of the experiments suffered from lack of thinking and planning time. After taking considerable time to think about the design and results of Experiment 1, I think instead of conducting Experiment 2, it would have been better to take a step back and investigate whether children are able to engage in cognitive rehearsal, and if so from what age. I also think it would have been more appropriate to look at cognitive rehearsal in a separate set of experiments to that of memory bias and interpretation bias. The reason for this is that it may be more appropriate to use mildly threatening information (or a mildly threatening experience) when investigating cognitive rehearsal, whereas ambiguous information is more appropriate when investigating memory bias and interpretation bias.

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## 9 Appendices

### 9.1.1 *Appendix A: Parent's Letter*



Dear Parent,

I invite your child to take part in a study on feelings and behaviours towards novel animals in children. This study is an important part of our ongoing research aimed at helping children who suffer with anxiety. The purpose of this research is to establish why some children are more likely to develop animal fears than others.

Your child will be under no stress, risk or discomfort from taking part in this research. Based on past experience, it is anticipated that your child will find the session an enjoyable and educational experience. As a participant your child will be asked to partake in some fun animal-based activities with the guidance of myself, they will then hear some information about an animal and finally they will be offered the opportunity to approach the animals.

Participation is voluntary and confidential and your child is free to withdraw from this study at any time. Every child who participates will receive a free CATT Lab T-shirt.

If you have any questions regarding participation of your child in this research or the aims of the research, please feel free to contact Dr Andy Field [andyf@sussex.ac.uk](mailto:andyf@sussex.ac.uk) or myself Zoë Nightingale [Z.C.Nightingale@sussex.ac.uk](mailto:Z.C.Nightingale@sussex.ac.uk).

Many thanks for your help.

Yours sincerely,

Zoe Nightingale

## Consent Form

As part of a project looking at why some children more readily develop animal fears, it is necessary to collect data from 'normal' (non-anxious) children. With your agreement, your child will take part in a short experiment in which they will complete (with the researchers help) some questionnaires and then hear some information about some animals. They will then have the opportunity to approach the animals. The versions of the questionnaires I will be using have been specially developed for children under 10 years old. Your child will then participate in some fun and factual exercises about the animals, they will receive a t-shirt and any questions will be answered.

**As a participant, your child will be under no stress, risk or discomfort from taking part in this research. In past experiments, using similar procedures, the children have enjoyed the experience.**

Your child is automatically assigned a code, their name will never be attached to the data collected from them so the information is completely confidential. The study has been reviewed by the ethics committee of the Psychology Department, University of Sussex. Please note Zoë Nightingale has been CRB checked.

If you are happy for your child to participate then please explain to your child that if at any point they do not wish to continue with the experiment they should tell the experimenter and they can stop.

---

If you have:

- ✓ Read the information above and in the cover letter and understood it
- ✓ Asked questions if you wanted to, and got satisfactory answers
- ✓ Explained to your child that they are free to withdraw from the study at any time, without giving a reason

Please sign below to indicate that you agree for your child to take part in the study and return this sheet of paper to the school by the 3rd November 2008.

Name of child (in block letters): \_\_\_\_\_

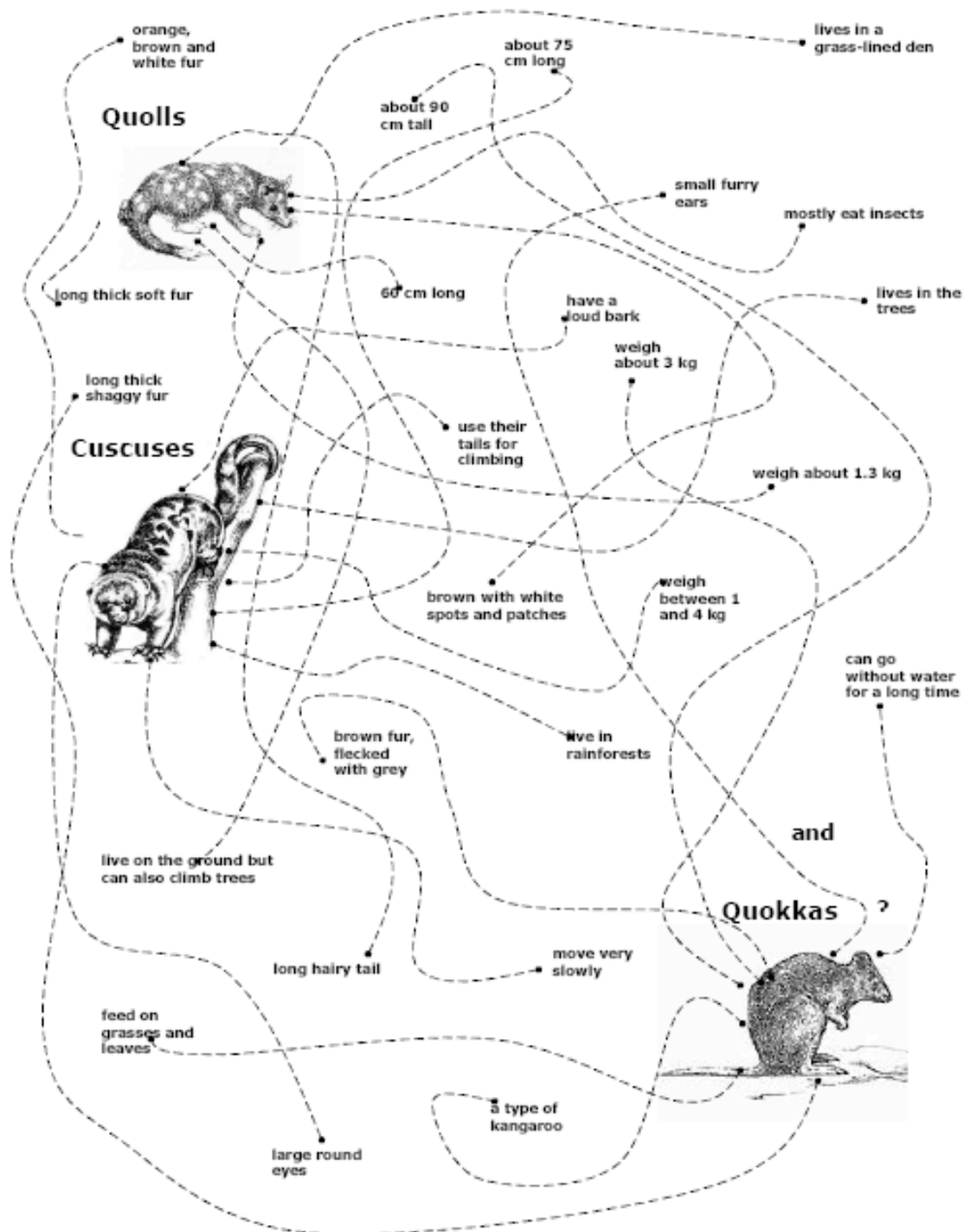
Name of Parent (in block letters): \_\_\_\_\_

Parent's signature: \_\_\_\_\_ DATE: \_\_\_\_\_

## 9.1.3

## Appendix C: Activity sheets

Can you untangle the truth about...



## The Truth About Quolls, Cuscuses and Quokkas

### Quolls (genus *Dasyurus*)



Quolls are found in many habitats including grasslands, rainforests, eucalyptus forests bounded by agricultural fields, alpine areas, and scrubland. Although they can live in a wide variety of habitats, some species, such as the Eastern Quoll, have become endangered because of competition from wild cats, dogs and foxes.

The quoll is nocturnal (most active at night). During the day it retreats to a grass-lined den in a burrow, a rock-pile, or a hollow log.

The quoll is about 60 cm long including a long tail, and weighs roughly 1½ kg. The female is slightly smaller than the male. It has thick, soft grey-brown to black fur with white spots. The long tail is hairy and has no spots.

Quolls are carnivores (meat-eaters) who mostly eat insects (especially grubs and beetles), but also occasionally prey upon rabbits, mice and rats. They sometimes scavenge carrion (dead animals that they find) and eat fruit. They compete with the Tasmanian Devil for food.

Up to 18 young are born in a litter, but only 6 babies survive after 2 days. The young spend their early months in the mother's pouch, each drinking milk from one of her 6 teats.

### Cuscuses (genus *Phalanger*)



The spotted cuscus lives in lowland tropical rainforests and neighbouring mangroves, which are found only in the very north of Australia.



Cuscuses are nocturnal, and in the daytime they sleep curled up in hollow trees and clumps of vegetation. When they are active, they move around slowly, making them an easy target for people who hunt cuscuses for their thick soft fur.

Cuscuses can vary in size from as small as a mouse to as big as a large domestic cat, and weigh between 1 and 4 kg. The spotted cuscus is usually about 75 cm long, with its body being 35 - 45cm and its tail between 30 - 40 cm. It is sometimes described as having a monkey-like appearance. This is especially true of the face, which is round with large eyes, a sensitive nose and tiny ears. It has dense fur, which is shades of orange, brown and white. Their tails are curled towards the end, and have no fur from about halfway down. The cuscus' tail is prehensile (meaning that it can hold onto things) so it can wrap it around branches and tree limbs for more security when it's climbing.

Cuscuses mainly eat fruit, leaves, nectar and insects, but they do sometimes eat small animals, like birds. The spotted cuscus has few enemies, but if it is frightened it can attack with its front paws and will use its loud bark to scare intruders away.

Typically, the female has only one baby, which is raised in her pouch until it is ready to leave, when it is carried on the mother's back.

Use the information above to answer these questions:

1. What colour fur do quolls have?
2. Which animal lives in the trees?
3. Which animal has white spots?
4. What does the cuscus' tail help him to do?
5. How big is a quoll?
6. Why might it be easy for hunters to catch a cuscus?

## **Ambiguous information**

### **The Quoll /The Cuscus**

Have you never heard of a quoll/cuscus? Well, quolls/cuscuses come from Australia; they have white shiny teeth, scruffy fur and big black eyes that watch you. Quolls/Cuscuses have long sharp claws that they use to dig and scratch. They also have a very unusual smell and make strange noises.

Quolls/Cuscuses live in dark places and they can be hard to see. They like to be by themselves and their nests can be very messy. Other animals keep away from quolls/cuscuses.

Quolls/Cuscuses are nocturnal animals which means they sleep during the day and creep out at night. Quolls/Cuscuses can jump quite high and move very quickly. They are so quiet and fast when they move that you can't hear them even when they are very close to you. If you go to the woods and see a quoll/cuscus hiding there, you never know what it might do.

Quolls/Cuscuses feed on all sorts of things. They eat quickly, greedily and gulp down their food. They get very thirsty when they eat and so they drink whatever they can.

9.1.5 *Appendix E: Interpretation bias and Memory Questionnaire.*

## Interpretation Bias and Memory Questionnaire

### The Quoll or the Cuscus-Depending on Counterbalancing Order.

**1) Prompt: what can you remember about how a Quoll looks?**

.....

.....

- (a) Quolls have long sharp claws that they use to scratch. What do you think they scratch?

.....  
*Which of these do you think is the most likely?*

They scratch humans and other animals { }

They scratch trees { }

- (b) Quolls have big black eyes that watch you, why do you think they watch you?

.....

*Which of these do you think is most likely?*

They are waiting to attack you { }

They are scared of you { }

- (c) Quolls have an unusual smell, what do you think they smell of?

.....

*Which of these do you think is most likely?*

They smell disgusting like rotten egg { }

They smell fresh a bit like strawberries and flowers { }

(d) Quolls make strange noises, what sort of noises do you think they make?

.....

*Which of these do you think is most likely?*

They make freighting growling noises { }

They make purring noises like a cat { }

(e) Quolls have scruffy fur, why do you think they have scruffy fur?

.....

*Which of these do you think is most likely?*

They are dirty and have fleas { }

They like to play in the leaves and their fur gets messy { }

**2) Prompt: what can you remember about where a Quoll lives?**

.....

.....

(a) Quolls live in dark places and they are difficult to see, why do you think they live in dark places?

.....

*Which of these do you think is most likely?*

The dark keeps them safe from other animals {}

The dark makes it easier for them to creep up and attack other animals and humans {}

(b) Other animals keep away from quolls. Why do you think that is?

.....

*Which of these do you think is most likely?*

Other animals know that quolls prefer to be on their own so they just leave them in peace { }

Other animals are scared of quolls because they can be dangerous { }

(c) Quoll's nests can be very messy, why do you think their nests are messy?

.....

*Which of these do you think is most likely?*

Their nests are full of rotten animal bones that the quolls have killed and eaten {}

Their nests are made from hay and leaves that get blown about in the wind {}

**3) Prompt: what can you remember about how a Quoll behaves?**

.....

- .....
- (a) Quolls are so quiet and fast when they move that you can't hear them even when they are very close to you. Why do you think they are so fast and quiet?
- .....

*Which of these do you think is most likely?*

They do not want to disturb other animals in the wood because they are shy and nervous { }

They attack other animals and humans and so do not want to be heard { }

- (b) If you go to the woods and see a Quoll hiding there, you never know what it might do but what do you think it might do?
- .....

*Which of these do you think is most likely?*

They would jump up and attack you { }

They would hide in the bushes because they are shy and scared of humans { }

- (c) Quolls are nocturnal animals which means they sleep during the day and creep out at night, why do you think they creep out at night?
- .....

*Which of these do you think is most likely?*

Because it is cooler at night { }

Because most animals are sleeping, so it is easier for quolls to attack them { }

**4) Prompt: what can you remember about what a Quoll eats and drinks?**

.....

(a) Quolls eat all sorts of things, what sorts of things do you think they eat?

.....

*Which of these do you think is most likely?*

They eat berries { }

They eat raw meat { }

(b) Quolls eat quickly, greedily and gulp down their food. Why do you think they eat like this?

.....

*Which of these do you think is most likely?*

They are vicious carnivores { }

They don't want to be attacked while they eat { }

(c) Quolls get very thirsty when they eat and so they drink whatever they can, what do you think they like to drink?

.....

*Which of these do you think is most likely?*

They drink water { }

They drink blood { }

(d) Quolls like to be by themselves, why do you think they like to be by themselves?

.....

*Which of these do you think is the most likely?*

They are nasty and do not like other animals { }

They are shy and nervous of other animals { }



9.1.6 *Appendix F: Ethical Approval Certificate*

**University of Sussex**

**School of Life Sciences Research Governance Committee**

**0.1.1 CERTIFICATE OF APPROVAL**

<b>Title of Project</b>	<b>The effect of trait anxiety on rumination and memory of ambiguous Information in children</b>
Principal Investigator	Dr. Andy Field
Student	Zoë Nightingale
Collaborators	
Duration of approval (not greater than 4 years)	9 months

This project has been given ethical approval by the School of Life Sciences Research Governance Committee.

NB. If the actual project start date is delayed beyond 12 months of the expected start date, this Certificate of Approval will lapse and the project will need to be reviewed again to take account of changed circumstances such as legislation, sponsor requirements and University procedures.

Please note and follow the requirements for approved submissions:

Amendments to protocol.

- Any changes or amendments to approved protocols must be submitted to the committee for authorisation prior to implementation.

Feedback regarding the status and conduct of approved projects

- Any incidents with ethical implications that occur during the implementation of the project must be reported immediately to the Chair of the committee.

The principal investigator is required to provide a brief annual written statement to the committee, indicating the status and conduct of the approved project. These reports will be reviewed at the annual meeting of the committee. A statement by the Principal Investigator to the Committee indicating the status and conduct of the approved project will be required on the following date(s):

December 2008, December 2009.....

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Signed: ..... Jennifer Rusted .....

Chair of the Research Governance Committee

Date: .....6 November 2008.....

